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JUNE, 1955

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING
PRODUCING OPERATIONS AND MANAGEMENT

Gulf Publishing Company

$2 Per Year; 50 Cents a Copy

West Texas New Mexico Issue

**Featuring articles o
current activities in th
Drickey-Caprock Quee
Virey-Ellenburger, an
Jameson-Strawn trend**

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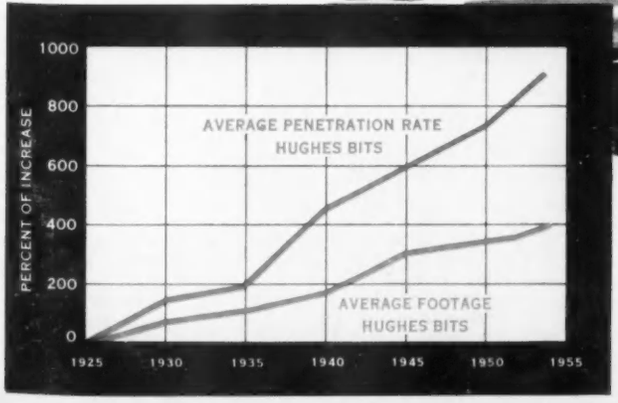
Here's progress in penetration

You are drilling wells twice as fast as you did 15 years ago and over nine times as fast as you did 30 years ago. This big increase in penetration rate stems from many sources: greatly improved drilling equipment, development of new drilling techniques, and better rock bits. Significantly, the gains in penetration rate, charted below, parallel the introduction of new Hughes bit designs: Acme self-cleaning cones in 1925; unit type bits in 1931; Tri-Cone bits in 1933; offset Tri-Cones in 1935; improved hard formation bits, such as the W-7R, in the early 40's; long-toothed OSC-3's in 1947; jet bits in the late 40's and Hugheset bits in the early 1950's. For assured performance operators the world over are running HUGHES bits.



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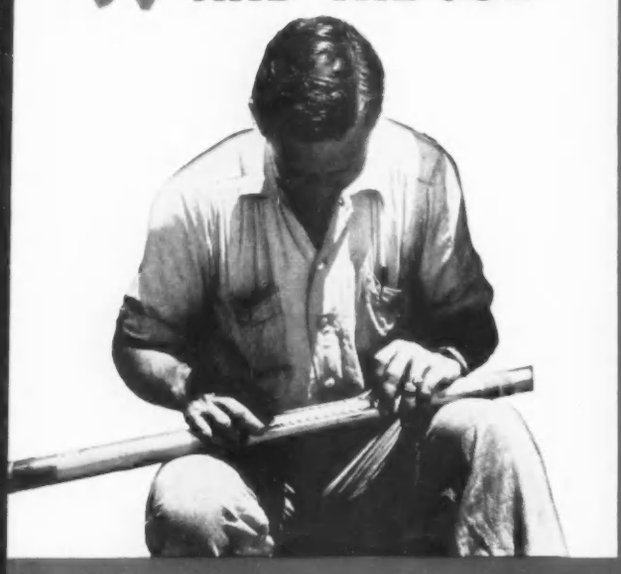
✓ THE CEMENT

✓✓ AND THE JOB



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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **Who's who in the petroleum industry** of the U. S.? What company ranks first in refining? In production? Which company was most active in drilling in 1954? The company reports provide the answers. Tables have been prepared showing the current rankings of some 30 oil companies in refining, production, and drilling. Turn to **Page 78. Annual Reports Reveal Company Operations** ... L. J. Logan

☐ **Beachcombing is no longer merely a pastime.** It has become the newest tool in oil exploration. A marine biologist has been combing the Gulf Coast beach from Mexico to Tampa, Fla., in search of marine specimens that may offer clues to oil-bearing deposits. **Beachcombing—A New Exploration Tool** .... **Page 80**

Turn the Page ➧

Colored boxes ☐ indicate West Texas-New Mexico articles in this issue

☐ **An unusual development of production** under the Ohio River has been carried out by The Carter Oil Company. Wells have been drilled directionally to spots beneath the bed of the river. Surface locations of the drilling rigs were on land along the river bank in Kentucky and on an island in the middle of the river between Kentucky and Indiana, near the Illinois border. Turn to **Page 82** for a brief description of the development. **"Offshore" Production Inland**. . **Anthony Gibbon**

☐ **One major oil company's** most famous producer—and one of the oil industry's most interesting wells—is back on production after a long "retirement." **Stapleton Comes Back**. . . . . **Page 83**

☐ **What sort of leader are you?** A re-examination of the leadership facts of life shows that there are three approaches to leading engineers. They are: autocratic leadership, democratic leadership, and free rein leadership. These concepts were used to develop two tests, one for leadership tendencies and the other for followership. To learn what sort of leadership you exert and in what followership group you perform best, turn to **Page 84. How to Lead Engineers**. . . . . **Auren Uris**

☐ **The oil industry is among the leaders** in providing fringe benefits for its employes, over and above regular pay. Yet the industry is meeting demands for still more fringe benefits. It is therefore essential that serious study be given to proposals for any appreciable increases in employe benefits. If workers are to be assured that the fringe benefits can be maintained, the costs of the benefits must be held safely within productive income or earnings. For an analysis of this growing problem, turn to **Page 88. Employe Benefits Must Be Reasonable to Be Safe**. . . . . **Lee Laird**

☐ **Is management responsible** for a good safety program? Everybody at the AAODC Drilling Safety Clinic—from roughneck to contractor—agreed that the ultimate responsibility belongs to management. And what about a standardized training program as a means for reducing rig accidents? Read **Rig Safety—a Job for Management**. . . . . **Page 95**

☐ **The Changing Panorama.** Surpluses of petroleum products have been developing this year. Temporary, yes, but undesirable. Their real danger lies in the possibility of causing weak markets and in turn discouraging exploration for new reserves and an ultimate scarcity of U. S. oil. How can industry management help prevent surpluses? For a timely discussion, turn to **Page 96. Supply-Demand Balance is Essential**. . **L. F. McCollum**

☐ **Texas laws on leasing,** pollution, labor and other topics of great concern to oil were rewritten by the Legislature. For an up-to-the-minute roundup see **What Texas Legislature Did About Oil . . . Page 102**

WEST TEXAS-NEW MEXICO ARTICLES

☐ **More than one-fifth of all U. S. oil** is now produced in the Permian Basin of West Texas and southeastern New Mexico. Although it is outranked by two of the U. S.' larger or older provinces, this region is rapidly developing into one of the great oil reserves of the world. Today, oil output from this area amounts to almost 1.4 million barrels a day, nearly four times its pre-World War II rate. Turn to **Page 113. The Basin Is Still Booming**. . . . . **Cecil W. Smith**

☐ **A highly important trend development** is under way in western Midland County and eastern Ector County of West Texas. It is the Virey-Ellenburger trend play. It is possible that several fields may be joined together into one tremendous reservoir. The trend extends from the Sweetie Peck field northward about 16 miles through the Warsan, Virey, and Dora Roberts fields to the Headlee field and may cover an area four miles wide from east to west. Production is prolific. Some wells have tested as much as 3500 barrels a day. Oil of around 40 to 50 gravity is from the Ellenburger at about 12,000-13,000 feet. A company geologist who has spent more than three years specializing in this trend discusses the development. He describes the regional geology, drilling programs, completions, and drilling activity. This article includes important maps and a typical electric log. Turn to **Page 115** for this significant article. **The Virey-Ellenburger Trend**. . **James R. (Dick) Simmons**

☐ **New Strawn sand discoveries** have been popping out all over the Eastern Shelf area of the Permian Basin. As more and more wells were drilled, it appeared that a trend had developed. Activity is of boom proportions. Frank B. Conselman, a consulting geologist at Abilene, has "lived" with the Eastern Shelf for a number of years. He is well qualified to discuss

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

this trend. In an article starting on **Page 134,** he presents some geology, economic data, and information on drilling and production. **The Jameson-Strawn Sand Trend**.....**Frank B. Conselman**

☐ **The biggest shallow oil play** for southeastern New Mexico in many years is developing rapidly in southeast Chaves County. Twelve majors and 17 independent operators are active in the area. The month of March saw 27 rigs in operation, and the trend already had extended over 30 miles. Production is relatively shallow (3100 feet) and some wells have come in as prolific producers. Recovery estimated at approximately 150 barrels per acre foot. For more details on geology, drilling and production from this trend, including maps, cross-section, and logs, turn to **Page 156. The Drickey-Caprock Queen Sand Trend**..**F. L. Stead**

EXPLORATION ARTICLES

☐ **A new exploration technique** has proved effective in solving structural problems associated with formations in West Texas. Studies of alterations of minerals at the surface have reflected the subsurface structures of the Rawlings field in Coke County and the Todd Deep field of Crockett County. These studies also offer promise of disclosing subsurface structures in other areas where similar conditions exist. Working "blind" with samples from unrevealed locations, the geologist using the technique prepared contour maps indicating the structures. His clients later disclosed what areas were involved and it was found that the contour maps based on the mineralization studies conformed closely with contour maps based on actual subsurface geological data. For a description of this work, turn to **Page 171. Mineral Studies Outline West Texas Structures**.....**Bernard H. Lasky**

☐ **Study of outcropping rock strata** of eastern Oklahoma and eastern Kansas prompts Author T. E. Weirich to point up an important principle of oil accumulation. While the study is limited as to locale, the principle is applicable to other oil-producing provinces and strata, and should improve the chances of finding oil. See **Page 180. Regional Diagnosis of Oil Accumulation**.....**T. E. Weirich**

☐ **A new method** designed to minimize dry holes in infield drilling has been developed and is described briefly in an article beginning on **Page 184.** Typical examples of well locations are presented. **A New Way to Locate Offset Wells**.....**Anthony Gibbon**

DRILLING ARTICLES

☐ **Air drilling is progressing rapidly.** As additional experience and experiments provide more knowledge, practices will be improved and problems solved. For an up-to-date discussion of current practices and problems in air drilling, read the article starting on **Page 189. Air Drilling Is Developing Rapidly**....**M. M. Brantly and F. W. Smith**

☐ **The West Texas roughneck** is taking detergents out of the kitchen and onto the rig floor. Detergents are being sold in carload lots throughout the Permian Basin to wash down rig equipment. They're proving easier on the paint job. **Rig Washing Time in the Permian Basin**.....**Page 192**

☐ **A proper mud program** is essential to successful drilling operations in southeastern New Mexico. Because of widely varied conditions in different parts of this region, careful attention must be given to mud programs. The various problems encountered and some of the methods of combatting them with mud are discussed in an article starting on **Page 194. Mud Practices Vary Greatly in Southeastern New Mexico**.....**W. E. Schultz**

☐ **The two-bridge system** for detecting new gas shows from the bottom has been successful in evaluating qualitative gas changes. Qualitative gas change indicates that a new gas-bearing formation has been penetrated by the bit and, if the lithology and other conditions are favorable, the section should be tested for production. Turn to **Page 202. How to Use the Two-Bridge System to Detect New Gas Shows from Bottom**.....**Jack E. Bliss**

☐ **The selection of the proper type of drilling fluid** to drill a well is of prime importance. What should this selection take into consideration? The answers are included in the conclusion of a two-part article on **Page 207. How to Select and Use Rotary Drilling Fluids (Part 2)**...**Earl E. Huebotter, T. H. Dunn and Frank S. Bell**

☐ **Profit is what keeps** a drilling contractor in business. Elemental, of course. But not so elemental are the many factors that go into keeping the ledger on the profit side. One of these factors is an efficient and properly-engineered hydraulic system. This is especially true in shallow drilling. Turn to **Page 216. More Efficient Rig Hydraulic System Means More Profit in Shallow Drilling**.....**John Cassidy, Jr.**

☐ **Since plastic pipe may be used**—under certain conditions—as casing or liners for cementing through a productive zone and then perforating for production, the operator is interested in knowing how best perforating results can be obtained. Here is an answer based on seven tests using both shaped charge and bullets. **Page 222. Perforating Plastic Pipe**....**D. S. McKee**

Turn the Page ➧

Colored boxes ☐ indicate West Texas-New Mexico articles in this issue.

PRODUCTION ARTICLES

☐ **Hydraulic fracturing in the Permian Basin** is the spark behind much of the increased activity in that area. More than 13,500 fracturing treatments have been logged in the Basin since the idea was first tried there six years ago. The score to date: a conservative estimate shows that the increase in recoverable reserves due directly to this type well stimulation is about 120 million barrels of oil! Where does it work? How does it work? Some of the amazing results are presented in an article starting on **Page 243. Hydraulic Fracturing in the Permian Basin**. . **R. E. Hurst, J. M. Moore and J. T. Rollins**

☐ **A new two-zone pumping installation** affords lower installation costs and flexibility of operation. Foundation expense has been reduced by setting two pumping units at ground level, yet each unit can be operated independently of the other. Turn to **Page 254. New Hookup Gives Flexible Pumping to Two-Zone Wells** . . . . . **Cooper Richards**

☐ **Early pressure maintenance** by gas and water injection permitted an allowable increase of 50 percent in the Salt Creek field of Kent County in West Texas. The field was 100 percent unitized before development was completed and plans for pressure maintenance got under way long before the reservoir pressure approached the "bubble" point. Details on this accomplishment, what was done, how it was done, the reservoir story, and performance data are shown in. . . **Early Pressure Maintenance Pays Dividends at Salt Creek Field** . . . . . **Page 256**

☐ **Seven methods of artificial lift** for deep wells in the Permian Basin have been compared . . . economically and performance-wise. Included are—two types of beam pumping, long-stroke hydraulic units, three hydraulic systems, and electrical centrifugal pumping. Lifting problems and practices are discussed briefly. Limitations of the various methods are pointed out. For some interesting conclusions on this important problem, not only in West Texas and New Mexico, but in all deep-producing areas, turn to **Page 266. Comparing Artificial Lift Methods for Deep Horizons** . . . . . **C. D. Borland, Jr.**

☐ **The atom has found its way** into petroleum production operations. As atomic energy research spread out into diversified fields, new uses for radioactive substances were found in petroleum production. Today it has become an indespensible tool which has provided the oil man with information heretofore impossible to obtain. Its use is expanding because it is not only versatile, but readily available. The story of its many applications are told in an article on **Page 274. Radioactive Tracers Solve Production Problems**. . **L. F. Tischler**

INTERNATIONAL ARTICLES

☐ **Pakistan is going to save millions of dollars** in foreign exchange. The reason? The $150 million natural gas pipe line connecting the Pakistan capital to Sui, Baluchistan, gas field has been completed. Fuel-shy heavy industries will switch over to natural gas. For details, see. . . **Last Joint of Pipe Laid on Pakistan Pipe Line** . . . . . **Page 297**

☐ **Bulgaria has joined the ranks of crude-producing nations**. And despite Russian secrecy surrounding the development, WORLD OIL has obtained authentic photographs of the operations. Turn to **Page 298** for a brief description of operations leading to the discovery and progress to date. **Bulgaria Joins Ranks of Oil-Producing Nations** . . . . . **Don Kliewer**

☐ **Petrobras has immediate plans** for further testing of the potentially-productive Brazilian oil area in the Amazon Basin found by the recent completion of a 250-barrel-a-day discovery well at Nova Olinda on the Madeira river. See **Page 300** for data on the discovery well and government oil monopoly plans. **Petrobras to Push Amazon Tests** . . . . . **Don Kliewer**

☐ **Germany's goal.** The West German Oil Producers Association expects an annual production of 25 million barrels of oil by 1959. This compares with the 1954 yield of almost 19 million barrels. This prediction is supported by recent estimate of proven and probable reserves published by the German Geological Society. Facts and figures on **Page 302. Germany's Goal: 25 Million Barrels of Oil in 1959** . . . . . **A. M. Stahmer**

☐ **Oil for airfields of Pacific.** More than 8000 miles from San Francisco lies Wake Island, a Pacific atoll which has bounced back from Japanese control in December, 1941, to a modern, well-staffed airport catering to transoceanic flights. All because the link between America and the Far East is oil. **Oil Fuels the Facilities of Mid-Pacific Airport** . . . . . **Page 306**

☐ **U. S. equipment abroad.** When Australasian Petroleum Company decided to explore for oil in Papua on the island of New Guinea, it elected to use U. S. equipment. For details on the progress of the two wells and information about the equipment being used, read. . . **Australasian Turns to U. S. Equipment for Papuan Tests** . . . . . **Page 308**

Looking Ahead . . .

. . . **Congress will pass gas legislation this year** and President will sign it. This flat prediction, first from a congressional leader on Ike's attitude toward Natural Gas Act amendment, was made by Senate Majority Leader Lyndon Johnson. Johnson predicted Harris-Fulbright bill will go to White House without crippling amendments.

. . . **Offshore drilling at record depths** is projected by Standard Oil Company of California. $5 million barge capable of drilling in 100-150 feet of water is on firm's drawing board.

. . . **Independents will watch imports volume** more carefully than ever, now that President will have restrictive authority in event brought-in oil "threatens national security." IPAA last month protested that U. S. bought 19 percent more foreign oil in February-March-April than in 1954 period; predicted that imports from May through July will average 1.1 million barrels daily, up 9 percent from 1954 period; and estimated reduction of 400,000 barrels daily in domestic production for May through September.

. . . **Imports will be factor in improved earnings of international companies** in 1955, compared with remainder of industry, according to Standard & Poor's Industry Surveys. Other reasons: International companies will have benefit of sharper rise in demand outside U. S., and ". . . somewhat better profits of these companies within the U. S. should help . . ."

. . . **Guatemala's new oil law permitting concessions** for the first time in this Central American country is expected to be approved within two months.

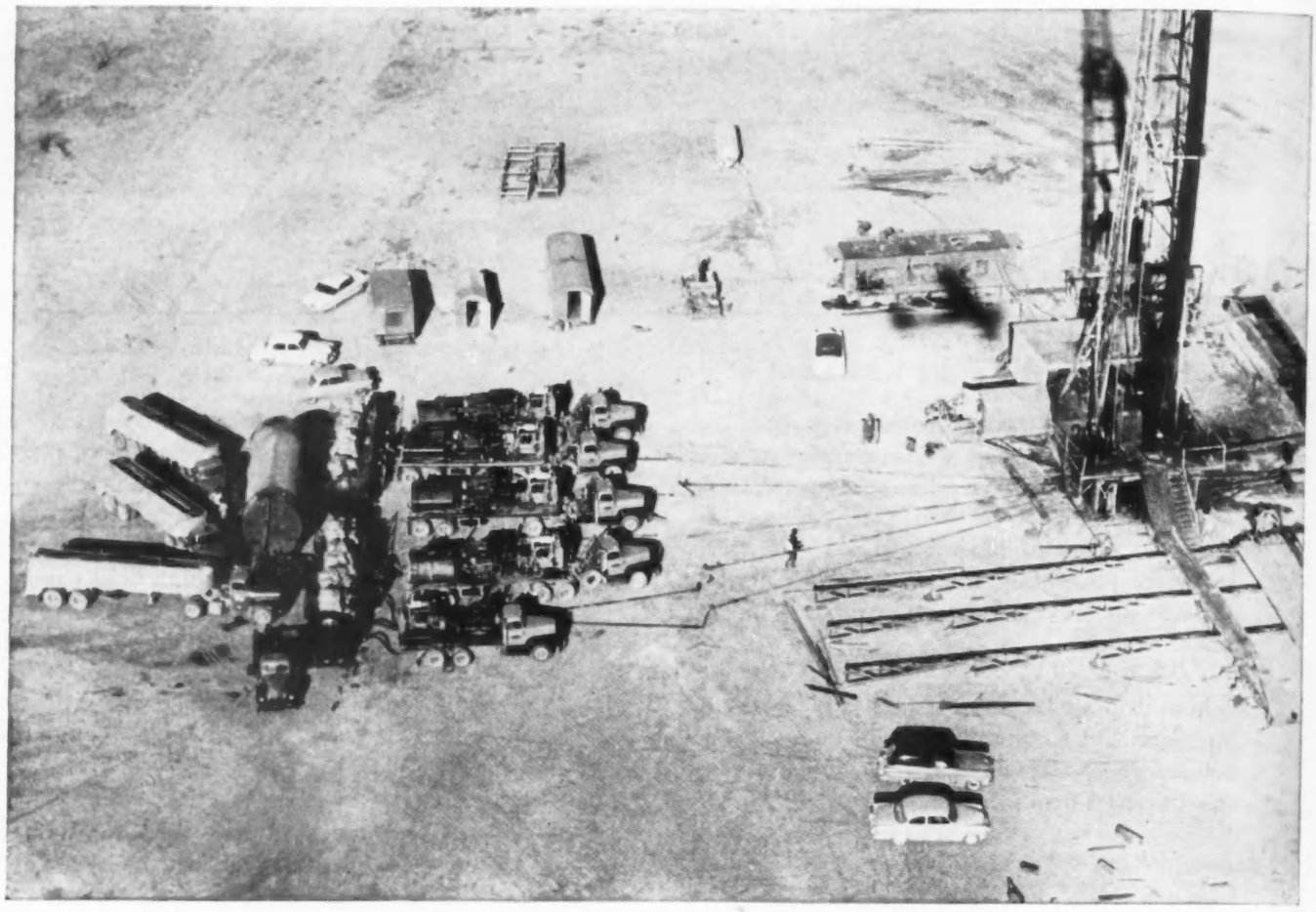
. . . **$300 million will be spent on atomic energy research** by non-government organizations in next four years. This is prediction of Atomic Industrial Forum after year-long study. Report says between 3 and 5 million kilowatts of electric capacity must be built and operated on uneconomical or break-even basis before reactor-generated electric power can become competitive with conventional power.

. . . **Island drilling in Alberta's Pembina field** will be tried by Texaco Exploration Company. Idea, borrowed from offshore operations, would permit drilling when muskeg conditions make rig movements impossible. Company will drill directionally from clay mound large enough to move rig 30 feet.

. . . **Third sale of oil and gas leases in Gulf of Mexico's** Outer Continental Shelf will be held July 12 at New Orleans. Bulk of lands advertised, 458,095.55 acres, are off Louisiana; however, sale will embrace 674,095.55 acres of submerged lands off both Louisiana and Texas extending as far as 60 miles from shore and to waters 100 feet deep. Offered lands have been divided into 210 tracts varying in size from 937 to 5760 acres.

. . . **Industry's 27.5 percent depletion allowance** will be given congressional study for possible 1956 tax purposes. Heading study group will be Chairman Mills (D-Ark.) of joint economic subcommittee. Actual study will be made by outside experts in business and labor.

. . . **Growing trend toward entry into oil operations abroad** by U. S. oil companies is underscored by formation of Iricon Agency, Ltd. Agency represents active participation in Iranian oil consortium, established last October, by nine U. S. oil companies—American Independent Oil Company, The Atlantic Refining Company, Hancock Oil Company, San Jacinto Petroleum Company, Signal Oil and Gas Company, The Standard Oil Company (Ohio), Tide Water Associated Oil Company, Richfield Oil Corporation, and Pacific Western Oil Corporation. Iricon, with an aggregate 5 percent interest, joins five U. S. and three European companies in consortium.



HIGH-INJECTION-RATE

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DOWELL treatment resulted in over 12,000 extra barrels of oil in 6 months

Large-volume, high-injection-rate Sandfrac* treatments are building an encouraging record of successes. This new high-injection technique is achieving increased penetration which has resulted in improved recoveries over long periods.

In one such case a well with an initial potential of 332 BOPD, flowing, had fallen off after nine months, so that it was pumping only 8 BOPD. At this point a high-injection Sandfrac treatment was performed by Dowell—21,000 gallons of oil and 31,000 pounds of sand were pumped into the well at an average injection rate of 45.4 BOPM. Immediately following this, the well tested 315 BOPD. After six months the well still potentialed 96 BOPD. The estimated cumulative production during the 6 months period was 13,159 barrels.

Dowell has designed special mixing units and diesel pumping equipment to handle high-injection Sandfrac treatments. This is just one example of the way Dowell's versatile services are engineered to meet the needs of the oil industry.

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services for the oil industry

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Better Understanding Is Needed

Hopes for the future in America depend upon maintenance of a free enterprise system under which both labor and capital can operate. Continued prosperity is a necessity for both. More effort needs to be made to create greater trust and understanding between the two.

George V. Holton, chairman of the board of Socony Mobil Oil Company, made the following pertinent observations on this subject at the company's annual shareholders meeting:

"A serious business recession is being predicted by various groups. My hunch is that if we are in for bad times they will result in no small part from our impatience to own everything we want today instead of waiting until tomorrow, when we can better afford it. The over-generosity of government with the taxpayers' dollars for give-away purposes which have such an alluring social appeal, could hasten the day of reckoning that always comes when for too long we continue to spend more than we receive.

"One who expresses this view risks being regarded as opposed to social betterment, which I am not. The all too common failure to distinguish between desirable objectives and what must be done to achieve them is but another manifestation of our national impatience. From it arise the recurring arguments between those who want to march now to the Promised Land across the river, and those who, in case no one is around to roll back the river, favor building a bridge first. The bridge to lasting social gains is the creation of enough earning power to support them. The more we spend future income to satisfy today's wants, the more we are inclined to demand guarantees that such future income be uninterrupted no matter what happens—and the less able we are to meet such guarantees.

"Continued prosperity will depend in no small degree upon the relationship between capital and labor. Here again there is cause for concern. If we are to continue to benefit from free enterprise, business must be permitted to operate at a profit. It cannot do so if costs are greater than income. A major cost item in most businesses is labor. Consequently, the attitude of labor has an important bearing on whether or not there is to be any profit. In mentioning this I am not hinting at any sacrifices by labor for the benefit of shareholders. Rather I am trying to make clear that only through a friendly and cooperative relationship between those who invest their savings and the employees can there be a profitable business of lasting benefit to either . . .

"**I see serious trouble ahead** for the country as a whole if monopolistic unionism as found in a number of companies and industries becomes more widespread . . . When as a result of unreasonable demands labor costs reach a point which preclude a fair profit to the owners, they must be passed on to the consumer or the business will die. The business will also die if the price to the consumer becomes so high he cannot or will not buy.

"Elementary as is what I have said, these facts do not seem to be recognized by some very vocal and influential labor spokesmen. Their normal approach, perhaps copied after that unwisely adopted by management in another generation, is with a raised club and threats to close shop regardless of who may be hurt unless their specific demands, however, debatable, are met in full. If this type of approach, accompanied by the countenance of force, is to prevail, we shall have, in addition to economic chaos, both our business and our government run by a labor monopoly which is just another form of dictatorship. I doubt if this would benefit any of us very much, the union member not excepted . . .

"**The seriousness of the situation** would be greatly relieved if all concerned would direct more effort toward creating the trust and better understanding upon which the will to adjust differences through amicable compromise must rest. As opposed to this, unfortunately, people in high places with loud voices and ulterior motives have been for years purposely stirring up antagonisms between the components of our economic system. Management must do what it can to foster the loyalty and friendly support of each of its employees, whatever his or her job. Upon the success of such efforts and the cooperation of labor will depend in large measure the future of free enterprise."

Warren L. Baker

Annual Reports Reveal Oil Company Operations

By L. J. LOGAN, WORLD OIL Staff

• Here are the rankings of different U. S. oil companies in refining, production and drilling.

• Smaller companies drill 80 percent of wells and produce 40 percent of oil in U. S.

Domestic Refinery Runs and Crude Oil Production of U. S. Companies in 1954

(Data from all available annual reports of U. S. companies with refinery runs and/or crude production above 10,000 barrels daily.)

COMPANY and RANK IN REFINING	CRUDE RUNS TO STILLS			CRUDE OIL PRODUCTION	
	Total Barrels	Barrels Daily	Percent of U.S.	Barrels Daily	Percent of Runs to Stills
(1-A) Standard (N.J.) U.S. Affiliates, Total	262,874,800	720,205	10.35	386,509	53.7
1. Standard (N.J.) Net Share of U.S. Affiliates	252,032,475	690,500	9.92	343,250	49.7
Esso Standard Oil Co.	172,462,500	472,500	6.79	.....	.....
87% of Humble O. & R. Co.	72,560,175	198,795	2.86	289,500	145.6
Carter Oil Co.	7,009,800	19,205	0.27	53,750	279.9
2. Standard Oil Co. (Indiana)	211,517,500	579,500	8.33	249,600	43.1
3. The Texas Co.	204,229,185	559,532	8.04	320,488	57.3
4. Gulf Oil Corp.	195,888,000	536,679	7.72	210,918	39.3
5. Socony-Vacuum Oil Co. & Subsidiaries	189,002,110	517,814	7.44	227,148	43.9
Socony-Vacuum Oil Co.	90,378,015	247,611	3.56	.....	.....
Magnolia Petroleum Co.	63,103,025	172,885	2.48	171,200	99.0
General Petroleum Corp.	35,521,070	97,318	1.40	51,200	52.6
Other	.....	.....	.....	4,748	.....
6. Shell Oil Co.	157,262,000	430,855	6.19	267,655	62.1
7. Standard Oil Co. of Calif.	157,069,992	430,329	6.18	237,943	55.3
8. Sinclair Oil Corp.	145,472,307	398,554	5.73	128,516	32.2
9. Sun Oil Co.	85,929,540	235,424	3.38	110,821	47.1
10. Cities Service Co.	85,609,000	234,545	3.37	101,512	43.3
(10-A) Humble Oil & Refining Co.	83,402,500	228,500	3.29	332,759	145.6
11. Phillips Petroleum Co.	73,050,830	200,139	2.88	120,400	60.2
12. Atlantic Refining Co.	66,161,725	181,265	2.61	87,307	48.2
13. Tide Water Associated Oil Co.	63,868,907	174,983	2.51	88,723	50.7
14. Pure Oil Co.	47,177,805	129,254	1.86	65,680	50.8
15. Continental Oil Co.	46,104,610	126,314	1.82	125,520	99.4
16. Standard Oil Co. (Ohio)	44,170,110	121,014	1.74	32,192	26.6
17. Union Oil Co. of Calif.	41,246,000	113,003	1.62	72,274	64.0
18. Richfield Oil Corp.	41,137,000	112,704	1.62	57,011	50.6
19. Mid-Continent Petroleum Corp.	20,839,426	57,094	0.82	15,847	29.5
20. Skelly Oil Co.	16,754,647	45,903	0.66	61,081	133.1
21. *Plymouth Oil Co.	13,781,000	37,756	0.54	14,743	39.0
22. The Ohio Oil Co.	13,609,322	37,286	0.54	93,578	251.0
23. Sunray Oil Corp.	13,479,520	36,980	0.53	63,312	171.2
24. Lion Oil Co.	8,853,248	24,255	0.35	19,991	82.4
25. Deep Rock Oil Corp.	6,537,000	17,910	0.26	6,244	34.9
26. South Penn Oil Co.	3,283,905	8,997	0.13	10,124	112.5
†Total, 26 Companies	2,214,927,489	6,068,294	87.22	3,176,137	52.3
Remainder of Industry	324,636,511	889,416	12.78	3,169,953	356.4
Total, United States	2,539,564,000	6,957,710	100.00	6,346,090	91.2

* Through wholly owned subsidiary, Republic Refining Co., which has plant at Texas City, Texas. † Includes Item (1-A) for Standard (N.J.); excludes other data on that company and its subsidiaries, Esso Standard, Humble, and Carter.

SMALL COMPANIES, partnerships, and independent operators with wells yielding less than 10,000 barrels output per day accounted for approximately 40 percent of the crude oil production in the U. S. in 1954. They drilled about 80 percent of the wells that were completed. Independent refiners with crude runs to stills averaging less than 10,000 barrels per day accounted for about 13 percent of total U. S. refinery runs in 1954.

These figures are indicated by accompanying tables, compiled from the annual reports of oil companies covering 1954.

Vigorous, ceaseless competition in the U. S. petroleum industry is revealed by comparing the data here tabulated with corresponding data for a year ago, two years ago, and three years ago, published in WORLD OIL for June 1954, Page 66; May 1953, Page 86; and May 1952, Page 50.

In all divisions of the industry, many of the larger companies have ranked differently from year to year, in some instances getting ahead of certain competitors but being overtaken by others. While the larger concerns have competed with each other, they also have encountered competition from the smaller companies and operators. As a group the smaller concerns have accounted for varying proportions of the industry's activities.

During the past four years the smaller companies have accounted for approximately the same proportions of the country's crude production and refinery runs, but they have been somewhat increasing their share of the wells drilled.

Standard Oil Company (New Jersey), world's largest oil company, was No. 1 in the U. S. in crude production and refinery runs and No. 2 in drilling in 1954, as in 1953. Its affiliates ran to stills 720,000 barrels of crude per day, or 10.3 percent of the U. S. total; produced 386,000 barrels of crude and natural gas liquids daily, or 6.1 percent of the country's output; and drilled almost 1300 wells.

Foremost in drilling in 1954, as in

1953, was The Texas Company, with 1313 well completions. Texas again was No. 2 in production, with 320,000 barrels daily output, or 5 percent of the U. S. It continued No. 3 in refining, with runs to stills of 560,000 barrels daily, or 8 percent of the U. S. total.

Standard Oil Company (Indiana) remained No. 2 in refining, with runs to stills of 580,000 barrels daily, or 8.3 percent of the U. S. It continued No. 3 in drilling, with 1110 well completions, and rose to No. 4 from No. 5 in production, with output of 250,000 barrels daily or 3.9 percent of the U. S. total.

Shell Oil Company continued No. 3 in production, was No. 5 in drilling, and rose to No. 6 from No. 7 in refining. Shell produced 268,000 barrels daily, or 4.2 percent of U. S., drilled nearly 1000 wells, and ran to stills 431,000 barrels per day, or 6.2 percent of U. S. runs.

Gulf Oil Corporation rose to No. 4 from No. 5 in refining, with runs to stills of 537,000 barrels daily, or 7.7 percent of the U. S. Gulf also rose to No. 4 from No. 6 in drilling as 1070 wells were completed. In production Gulf remained No. 7.

Socony-Vacuum Oil Company dropped to No. 5 from No. 4 in refining but ran to stills 518,000 barrels daily or 7.4 percent of the U. S. total. It remained No. 6 in production, with output of 227,000 barrels daily, but dropped to No. 6 from No. 5 in drilling, with 848 well completions.

Standard Oil Company of California was No. 5 in production, No. 7 in refining, and No. 10 in drilling. Sinclair Oil Corporation ranked No. 7 in drilling and No. 8 in both production and refining. Continental Oil Company was No. 8 in drilling, No. 9 in production, and No. 15 in refining. Sun Oil Company in 1954 was No. 9 in refining and No. 11 in both production and drilling. Phillips Petroleum Company was No. 10 in production, No. 11 in refining, and No. 13 in drilling. Cities Service Company ranked No. 10 in refining and No. 12 in both production and drilling.

Net Domestic Crude Oil Production of U. S. Companies in 1954

(Company's net share; does not include royalty and co-owner interests.) Data from all available annual reports of U. S. companies with crude production and/or refinery runs above 10,000 barrels daily.

COMPANY and RANK IN PRODUCTION	Total Barrels	Barrels Daily	Percent of U.S.
(1-A) Standard (N.J.) U.S. Affiliates, Total	141,075,700	386,509	6.09
1. Standard (N.J.) Net Share of U.S. Affiliates	125,286,300	343,250	5.41
(a) 87% of Humble	105,667,600	289,500	4.56
(b) 100% of Carter Oil Co.	19,618,700	53,750	0.85
(1-B) Humble Oil & Refining Co.	121,457,000	332,759	5.24
2. The Texas Co.	*116,978,161	320,488	5.05
3. Shell Oil Co.	97,694,000	267,655	4.22
4. Standard Oil Co. (Ind.)	*91,104,000	249,600	3.93
5. Standard Oil Co. of Calif.	86,849,159	237,943	3.75
6. Socony-Vacuum Oil Co.	*82,909,000	227,148	3.58
Magnolia Petroleum Co.	62,488,000	171,200	2.70
General Petroleum Corp.	18,688,000	51,200	0.80
Other	1,733,000	4,748	0.08
7. Gulf Oil Corp.	*76,985,000	210,918	3.32
8. Sinclair Oil Corp.	46,908,416	128,516	2.03
9. Continental Oil Co.	45,814,800	125,520	1.98
10. Phillips Petroleum Co.	43,946,000	120,400	1.90
11. Sun Oil Co.	*40,449,706	110,821	1.74
12. Cities Service Co.	*37,052,000	101,512	1.60
13. Ohio Oil Co.	34,156,084	93,578	1.48
14. Tide Water Associated Oil Co.	32,384,000	88,723	1.40
15. Atlantic Refining Co.	31,867,000	87,307	1.37
16. Amerada Petroleum Corp.	27,078,255	74,187	1.17
17. Union Oil Co. of Calif.	*26,380,000	72,274	1.14
18. Pure Oil Co.	23,973,232	65,680	1.03
19. Sunray Oil Corp.	*23,108,792	63,312	1.00
20. Skelly Oil Co.	22,294,402	61,080	0.96
21. Richfield Oil Corp.	20,809,000	57,011	0.90
(21-A) Carter Oil Co.	19,618,700	53,750	0.85
22. Standard Oil Co. (Ohio)	*11,750,000	32,192	0.51
23. British American Oil Co., Ltd.'s U.S. Subsid.	8,200,000	22,466	0.35
24. Lion Oil Co.	7,296,572	19,991	0.31
25. Texas Pacific Coal & Oil Co.	7,049,079	19,312	0.30
26. United Gas Corp.	6,443,380	17,653	0.28
27. Mid-Continent Petroleum Corp.	6,148,999	16,847	0.27
28. Plymouth Oil Co.	5,381,277	14,743	0.23
29. Houston Oil Co. of Texas	5,214,594	14,287	0.23
30. South Penn Oil Co.	3,695,260	10,124	0.16
31. Deep Rock Oil Corp.	2,279,000	6,244	0.10
†Total 31 Companies	1,213,274,868	3,324,041	52.38
Royalty and Co-Owner Oil Produced, Est.	173,324,981	474,863	7.48
Gross Production Above Companies	1,386,599,849	3,798,904	59.86
Remainder of Industry	929,723,151	2,547,186	40.14
Total, United States	2,316,323,000	6,346,090	100.00

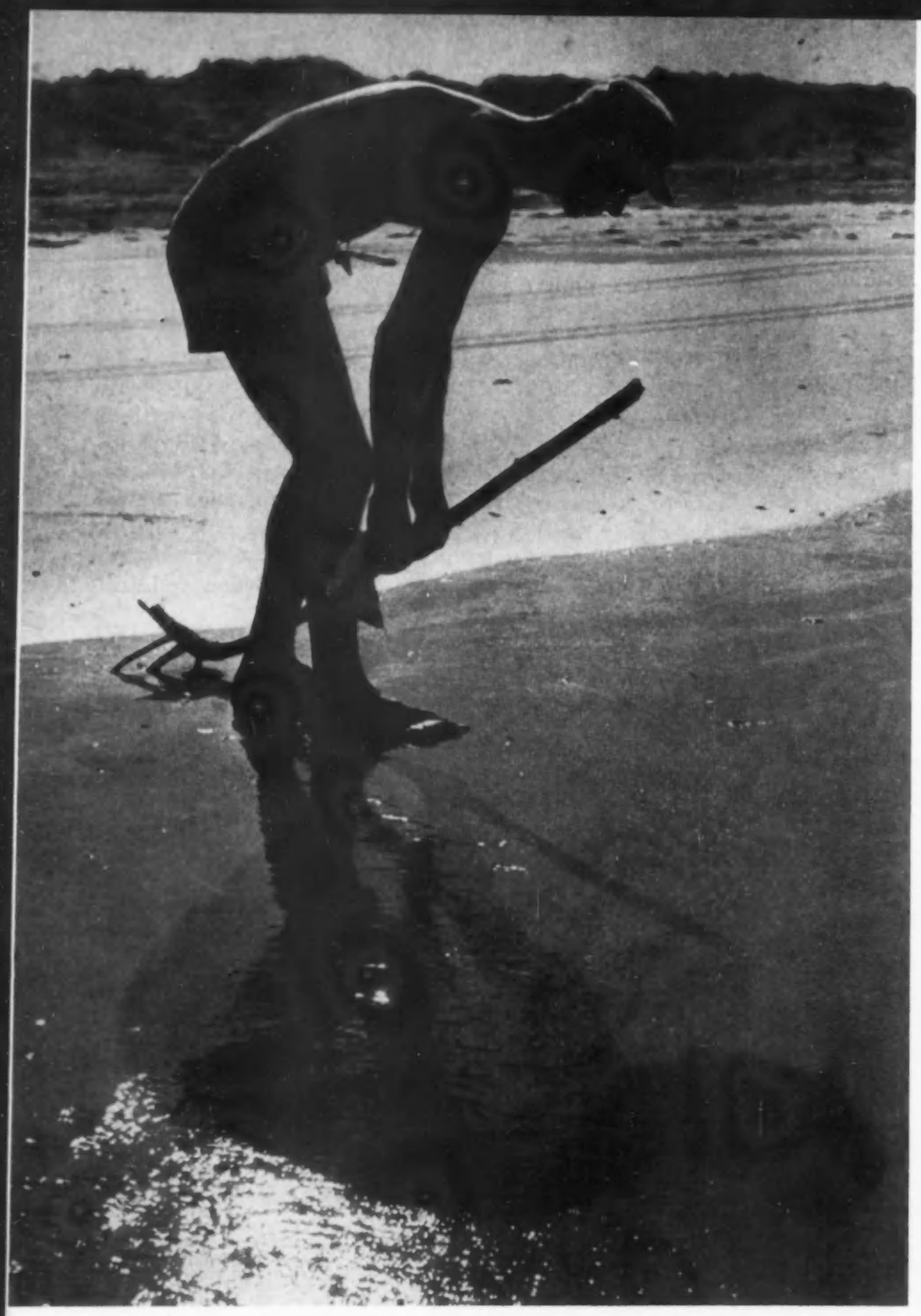
* Includes natural gas liquids. † Includes Item (1-A) for Standard (N.J.),—excludes other data on that company and its subsidiaries, Humble and Carter.

Number of Wells Completed in U. S. in 1954 by U. S. Companies

(Data from all available annual reports of U. S. companies with crude production and/or refinery runs above 10,000 barrels daily.)

COMPANY and RANK IN DRILLING	[1]Gross Wells	[2]Net Wells
1. The Texas Co.	1,313	.....
(1-A) Standard (N.J.), U.S. Affiliates, Total	1,291	.....
2. Standard (N.J.), Net Share of U.S. Affiliates	1,164	.....
87% of Humble	847	.....
100% of Carter Oil Co.	317	219
3. Standard Oil Co. (Indiana)	1,110	.....
4. Gulf Oil Corp.	1,070	.....
5. Shell Oil Co.	996	.....
(5-A) Humble Oil & Refining Co.	974	.....
6. Socony-Vacuum Oil Co.	848	.....
7. Sinclair Oil Corp.	.....	527
8. Continental Oil Co.	715	505
9. Ohio Oil Co.	702	.....
10. Standard Oil Co. of Calif.	.....	467
11. Sun Oil Co.	513	439
12. Cities Service Co.	.....	424
13. Phillips Petroleum Co.	629	406
14. Skelly Oil Co.	561	385
15. Union Oil Co. of Calif.	[3]392	.....
16. Amerada Petroleum Corp.	379	.....
(16-A) Carter Oil Co.	317	219
17. Atlantic Refining Co.	.....	198
18. Pure Oil Co.	279	.....
19. British American Oil Co.	258	.....
20. Sunray Oil Corp.	277	181
21. Tide Water Associated Oil Co.	292	154
22. Mid-Continent Pet. Corp.	208	.....
23. Lion Oil Co.	.....	127
24. Texas Pacific Coal & Oil Co.	139	106
25. Standard Oil Co. (Ohio)	147	97
26. Houston Oil Co. of Texas	132	71
27. Plymouth Oil Co.	102	79
28. Deep Rock Oil Corp.	.....	74
29. United Gas Corp. (Union Producing Co.)	102	.....
30. Richfield Oil Corp.	.....	[4]40
31. South Penn Oil Co.	38	.....
[5]Total 31 Companies	.....	[6]10,637
(Percent of U.S.)	.....	20.5
Rest of Industry	.....	41,265
(Percent of U.S.)	.....	79.5
Total, U.S.	.....	51,902

[1] Wells drilled by company, including wells owned jointly with others.
[2] Company's net share in wells it drilled. [3] Total Western Hemisphere. [4] Data include only productive wells. [5] Includes Item (1-A) for Standard (N.J.) excludes other data on that company and its subsidiaries, Humble and Carter. [6] For companies that reported only gross wells, net wells are here estimated as 70.7% of gross; this ratio being indicated by reports showing both gross and net wells.



Beachcombing biologist hunts for a donax, a tiny clam ranging in size from a pea to a large pebble.

BEACHCOMBING . . . *a new exploration technique*

A marine biologist roams the Gulf shoreline from Mexico to Florida, seeking specimens of modern sea life. They may provide clues to oil-bearing deposits.

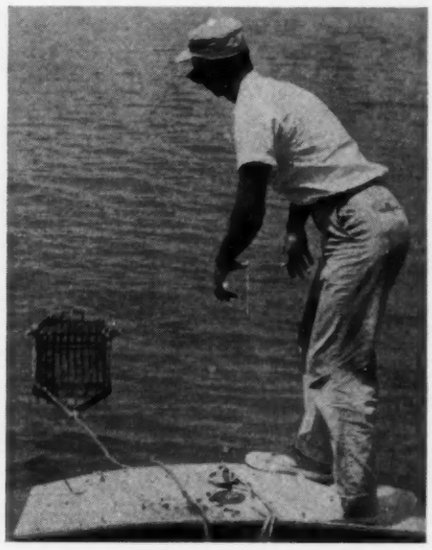
BEACHCOMBING is the newest tool in oil exploration.

Donald R. Moore, a graduate marine biology student at the University of Miami, has completed an unusual project for Shell Development Company's Exploration and Production Division in Houston—the collection and classification of samples of sea creatures and vegetation along 1000 miles of coast surrounding the Gulf of Mexico.

Shell's purpose parallels that of the several companies which have adopted the technique of skin diving for crabs, clams, snails and other sea creatures on the Continental Shelf. These crustaceans cling to the habitat of their fossilized forbears. If Shell learns enough about them, it may be possible to match recent samples against their ancient ancestors found in oil-bearing formations. This might give clues to the location of a buried limestone reef or sand bar, saturated with oil but sealed ages ago by sediments.

In his search to learn the distribution and types of sea life now inhabiting the bays and shallow waters of the Gulf Coast, Moore combed the beach from the Mexican border to Tampa, Florida, picking up specimens both dead and alive. Usually, he drove to locations and worked a lengthy stretch on foot. Sometimes he hired a boat and explored the shallow waters of the Gulf itself.

One tool used to explore the sea floor is a bottom sampler, a claw-like device which remains open until it strikes bottom. Then a spring snaps it shut.



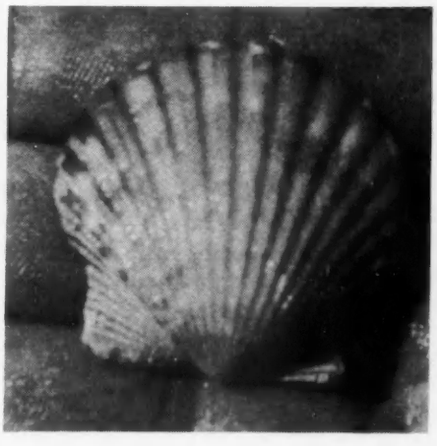
A dredge, resembling a wire basket, is dropped into water. When dragged across bottom, it collects samples.

Beachcomber's specimens . . .

Small barnacles attached to bottle.

Thin, tapering terebra, a form of marine insect.

Seaweed which forms a nest for an unidentified water species.



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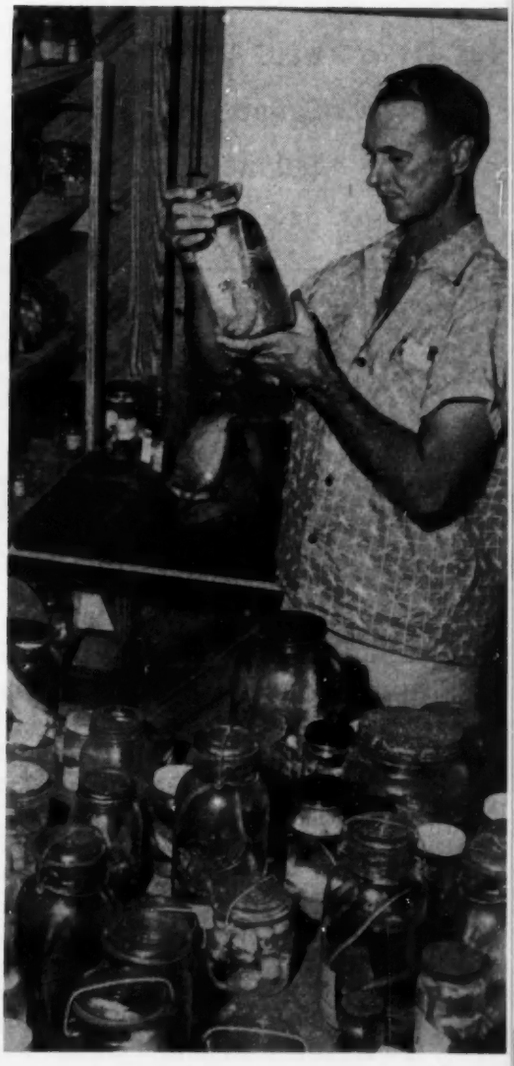
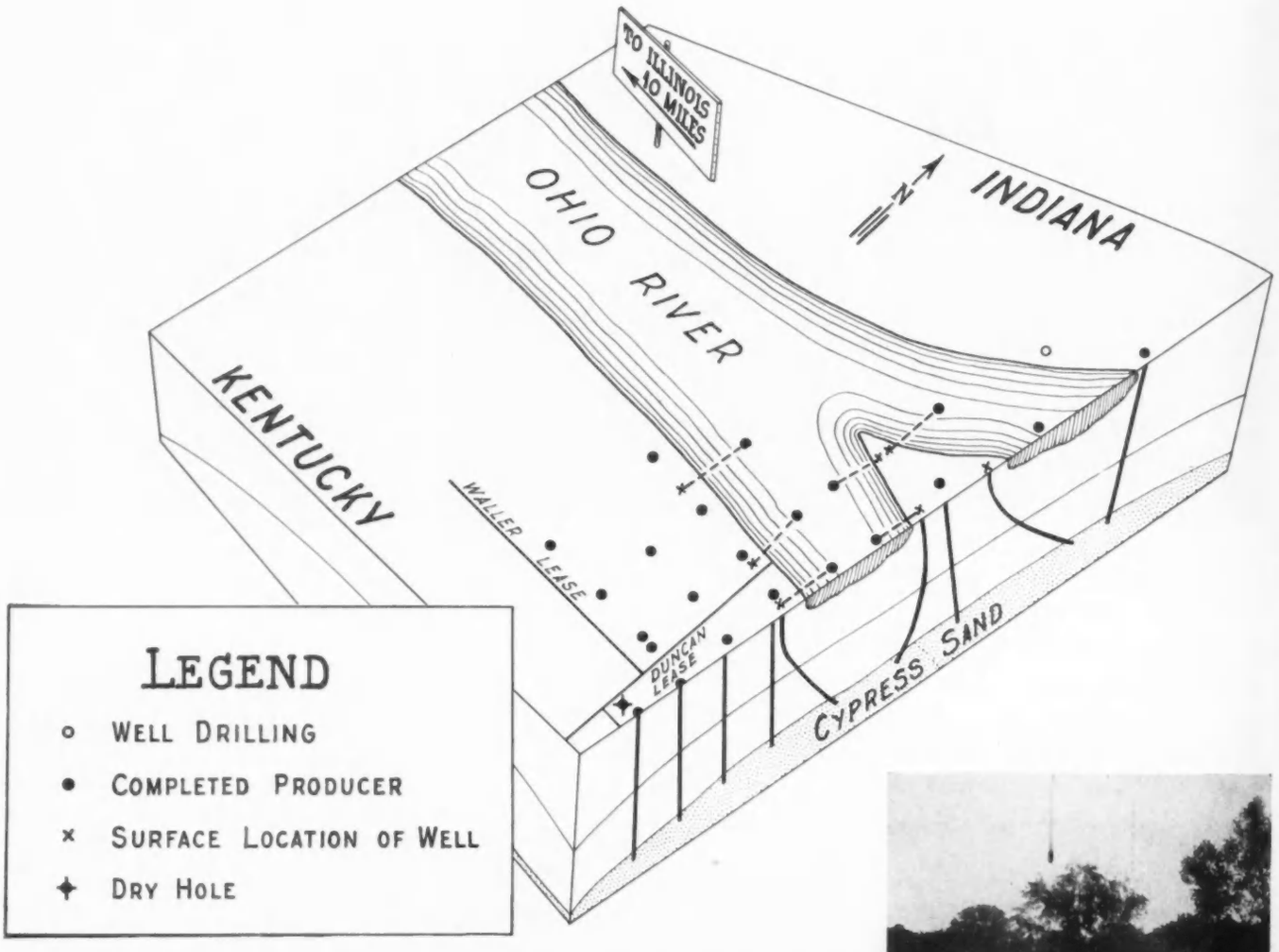


At the University of Texas Institute of Marine Science at Port Aransas, Texas, Donald R. Moore examines a large shrimp. He visited nine such laboratories during his trip.

—The End



CUTAWAY VIEW above of North Smith Mills pool showing directional holes under Ohio River on both sides of Diamond Island, natural "platform" used by The Carter Oil Company in its operations. Right is view looking south toward Kentucky from Carter's Bower 1 on Diamond Island. This was first well drilled from the island to bottom under Ohio River. Stilts are highest used in producing area—28 feet. Entire island is inundated during flood season.

'Offshore' Production Inland

The Carter Oil Company has drilled directionally to spots beneath Ohio River from the river bank and from an island in midstream.

By ANTHONY GIBBON, World Oil Staff

All The Offshore wells are not necessarily being drilled along the tidelands of the U. S.

In the tri-state area, far from salt water, The Carter Oil Company, Tulsa, Okla., has developed substantial crude oil production from wells which have been drilled to tap the rich Cypress sand below the Ohio River. Some of the wells have been drilled from the Kentucky bank of the river and some from Diamond Island, a natural drilling "platform" which is located in the river between Kentucky and Indiana.

This is the first time in the history of the oil industry that substantial production has been developed through directional drilling from beneath the bed of a large, navigable river.

This "marine" operation is actually part of the program for developing the North Smith Mills pool of Kentucky and Indiana. Carter began drilling over a year ago, with its first well about a half-mile south of the Ohio River. The field was extended until Carter had wells right along the north bank of the river.

When it was seen that the productive limits of the pool extended north under the Ohio River, Carter leased Diamond Island and completed a directional producer good for 271 barrels of oil a day from the Cypress sand at approximately 2500 feet.

The first try under the river was Carter's Waller No. 10 drilled on the Kentucky bank of the river. The well was drilled straight down for 400 feet where a whipstock was set to deviate

the hole under the river. A total of 14 whipstocks was used in drilling the well. It was finally bottomed in the Cypress at 2502 feet, total depth, with the bottom of the hole located 718 feet north and 63 feet east from the exact spot on the river bank where drilling started. The well tested 224 barrels of clean oil daily on swab on a 24-hour test.

Had the well been drilled straight down the Cypress sand would have been encountered at 2348 feet; thus the deflection of the hole was 154 feet.

The first "offshore" well to be drilled using Diamond Island as the "platform" was the Bower No. 1. So far five directionally-drilled wells have been drilled from Diamond Island.

The Ohio River at this point is about three-quarters of a mile wide. Drilling operations on Diamond Island extend east to a point where the island is one-third of a mile wide.

Since the successful completion of the Waller No. 10, Carter has drilled seven additional wells under the Ohio River. Carter engineers estimate the additional cost of the directionally-drilled wells is in the neighborhood of $16,000 per well.

Carter's "offshore" operations account for a substantial increase in its reserves in the North Smith Mills pool. The wells each tested between 250 and 300 barrels per day of high-gravity oil.

Five of the wells were directionally drilled from Diamond Island, three from the south bank on the Kentucky side of the river toward the Indiana shore.

Altogether, Carter has 28 producing wells and one dry hole in the pool, which is quite a record in any area.

Since the Ohio River is navigable, the U. S. Corps of Engineers controls all operations. The engineers must approve the route of any barge operating between the Kentucky shore and Diamond Island. At present crude oil produced from wells on the island is barged to the Kentucky shore. There it, together with crude produced from wells on land in the Kentucky sector of the pool, is picked up by a pipe line gathering system in the North Smith Mills pool.

All wells are drilled with rotary to near the top of the sand and are tailed in and completed with spudders or cable tools. —**The End**

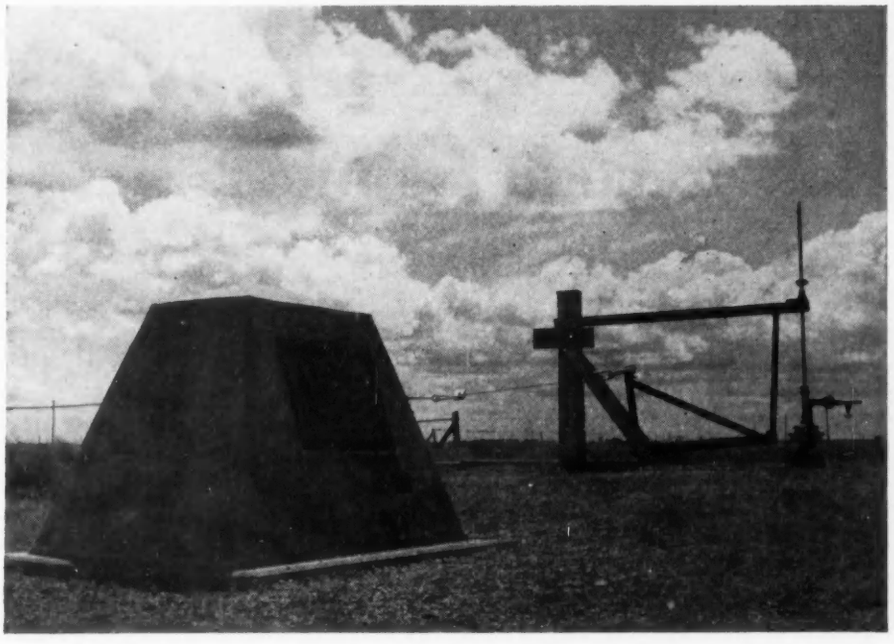


Photo by Fritz Henle, courtsey Cities Service Oil Company.

BACK ON PRODUCTION under water-flood after being abandoned for almost 20 years is this El Dorado, Kansas, pool discovery well—Cities Service Oil Company's Stapleton 1. The old pumping jack was replaced recently with a modern electric pumping unit. Marker in foreground was erected by Kansas oil men to commemorate the discovery.

Stapleton Comes Back

Fabled days of El Dorado recalled as pioneer discovery goes back on production.

Cities Service Oil Company's most famous producer—and one of the oil industry's most interesting wells—is back on production.

Back in 1915 Cities Service completed Stapleton 1, a wildcat that opened up the El Dorado pool in Butler County and put Kansas on the oil map. Since, the pool has proved to be the most prolific oil reserve in the state.

Now, thanks to technological progress, the Stapleton, which was offially "retired" 19 years ago, is now pumping 20 barrels of oil daily. It is part of Cities Service Oil Company's Pierpont water-flood project. Recently, it underwent a "face lift." Cities Service crews cleaned out the old hole, replaced the antiquated pumping jack with a modern electric pumping unit, and put it back on the company's list of producers.

All this, after the old veteran had produced about 150,000 barrels during its 20 years of activity as a primary producer. Under the stimulus of water-flooding, the old well, according to Cities Service engineers, is good for another 25,000 barrels before it goes completely dry.

Stapleton 1 not only opened the most prolific oil field in Kansas and one of the most important in the Mid-Continent area, but also it contributed mightily towards victory in World War I.

When German U-boats were menacing the Allied lifeline across the Atlantic and oil supplies were alarmingly low, Cities Service Oil Company's discovery of the El Dorado pool sparked feverish drilling activity which soon loosed the flood of oil upon which the Allies "floated" to victory.

When the well was "retired" 19 years ago Kansas oil men and officials of the Cities Service group, erected and dedicated a monument in its honor. More than 5000 attended the ceremonies.

Today, Stapleton's "comeback" is something of a modern miracle.

—**The End**

How to Lead Engineers

There are three approaches—autocratic, democratic and free rein. Do you know in which group you fit?

By AUREN URIS, Research Institute of America, New York City

WHAT KIND OF people are engineers, anyway?

You've seen engineers' income, hours worked, turnover rate, absenteeism, surveyed, averaged and charted. Any group, of course, may be studied on the basis of a shared activity. But how about engineers as people, as psychological beings?

Consider statements like these, for example:

"Engineers are easy to deal with."

"Engineers are tough to deal with."

You've surely heard engineers cheered or verbally sent to the showers in some such summary fashion. Is there really any justification for such group evaluation? Do engineers, psychologically speaking, represent a type of *homo sapiens* separate and apart from their fellow humans?

Engineers under the microscope. A recent study provides an interesting and revealing insight into the psychology of engineers as a group. The leadership and followership tendencies of an ASME group meeting on Long Island were tested. Included were men involved in research and development, design, standards, liaison, and production.

Before getting into the study results, here's some background information that will put the study in perspective.

A new approach to leadership. Within the last few years a somewhat new concept of leadership and followership has been developed. It's a flexible approach, and attempts to right the balance brought about by an overemphasis on democratic techniques.

There's no question but that democratic leadership has much to recommend it. The trouble is that in concentrating on the virtues of this one method, many people lost sight both of the handicaps of the democratic techniques and also of the virtues inherent in other possible approaches.

A re-examination of the leadership facts of life as they actually exist rather than as the theorists would like to see them, reveals this state of affairs: There are three leadership approaches or tools that may be used in leading a group of engineers—or any other type of group. Each of these three methods, under given conditions, has certain advantages. Each of the three methods likewise has certain disadvantages.

Here are the three leadership tools, and a brief description of each.

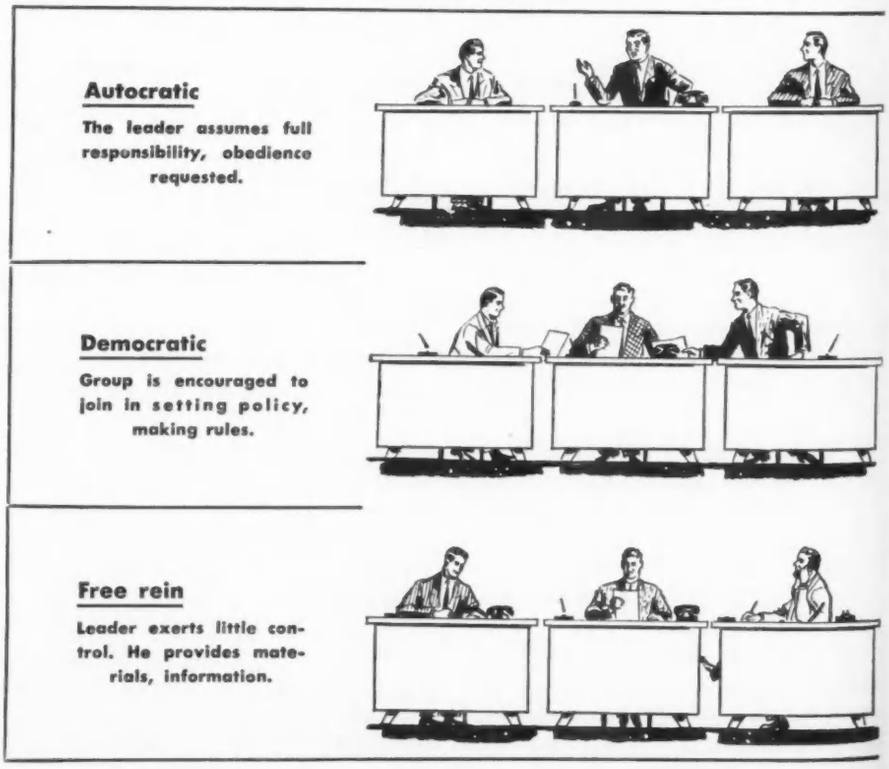
Autocratic leadership. Using this method, the leader assumes full responsibility for all group action. Obedience is his main request of subordinates. Policy and decision-making are his babies.

This approach is best when group members are inexperienced, dependent, or insecure. Or, when a critical situation requires immediate aggressive, single-minded action.

Democratic leadership. The leader draws ideas and suggestions from his group by discussion and consultation. Group members are encouraged to join in setting policy and in developing the regulations by which the group as a whole is to live and work.

This type of leadership is particularly effective where a work-group is cooperative and capable of carrying

Three Approaches to Leadership of Engineers . . .


Autocratic
The leader assumes full responsibility, obedience requested.
Democratic
Group is encouraged to join in setting policy, making rules.
Free rein
Leader exerts little control. He provides materials, information.

out group responsibilities. Or, when the benefits of group thinking are desirable.

Free rein. The leader exerts minimum control. He's on hand mainly to provide materials, information and so on.

This leadership method is particularly suited to individuals whose training and experience equip them to function pretty much on their own. Or, with groups—such as engineers—where individual imagination and initiative, given free play, best stimulate group progress.

Your followership. The "flexible" leadership concepts were used to develop two tests, one for leadership tendencies of individuals, the other for "followership" tendencies.

(These tests are reproduced at the end of this article. You may take them yourself, and evaluate your score, using the scoring instructions provided.)

1. **Autocratic** leadership is what you prefer if you—
   - . . . are most efficient working under complete and detailed instruction.
   - . . . show a marked respect for firmness in your leadership.
   - . . . accept authority unquestioningly.

2. **Democratic** leadership tends to be preferred by those who—
   - . . . like to consult with you on departmental problems rather than take the position of "That's your headache!"
   - . . . are active participants in productive group meetings.
   - . . . apply the principles of mutual respect among themselves.

3. **Free-rein** leadership attracts those who—
   - . . . place a high value on initiative and want to be self-reliant.
   - . . . seem to work best when given a completely free hand.
   - . . . are capable of assuming full responsibility for their actions.

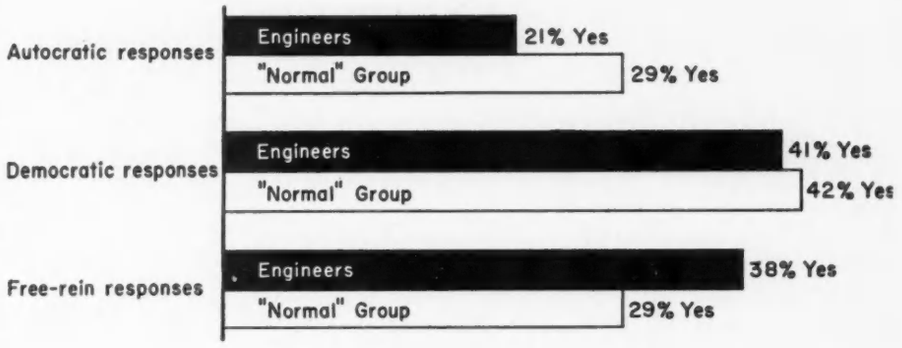


Figure 1
(Courtesy Research Institute of America)

Implications for engineers. The ASME group scores made in both the leadership and followership tests were compared to those of a so-called "normal" group. Here are the figures in the leadership area: The percentages indicate that "strength" of the tendency towards the type of leadership indicated:

Leadership Ratings

Autocratic responses:
- Engineers . . . . . 23 percent
- Normal . . . . . 23 percent

Democratic responses:
- Engineers . . . . . 48 percent
- Normal . . . . . 44 percent

Free Rein responses:
- Engineers . . . . . 33 percent
- Normal . . . . . 31 percent

Interpreting the results. The percentages above indicate relatively little difference between the engineering group and the "normal" group. The differences in scores are too small to be significant.

What this means is that, as far as the leadership tendencies of the engineering group tested, they were in no special way distinguishable from an average business group. There is the same marked preference for the democratic method, with the autocratic and free rein responses approximately equal.

It should be pointed out, however, that while the "normal" group shows only a 6 percent difference between its autocratic and free rein responses, the engineering group shows a difference of 10 percent. As you will see, this percentage—the difference in attitude towards autocratic and free rein methods—jumps decidedly in the followership test scores shown in Figure 1.

Explanation? How can the group engineering score be explained? There are two pretty clear implications, probably not unrelated:

- The kind of people who chose engineering as a profession like to work on their own, with a minimum of guidance. They want to be left on their own initiative, within the framework, of course, of the goals set them by their superiors. This same character trait, incidentally, probably applies to professional people in general, doctors, lawyers, writers, and so on.
- The conditions under which supervisors work tend to develop those habits, and preferences that go to make for self-reliance, and the exercise of personal initiative.

Test yourself. By taking the leadership and followership tests that follow, you'll be able to check your own findings against the group results given above.

No claims are made, as yet, for the scientific validity of these tests. But on the whole, individuals tested have agreed that their scores have a relation to their actual work experience. Even more to the point: those who have taken the tests have suggested personal gain in the increased insight into their own superior-subordinate job relationships.

Leadership Tests

The questions below tell you the type of leadership you prefer. Whether or not you now work under a superior, you undoubtedly have done so in the past. Answer the following questions, keeping in mind what you have done or feel you would do in the situations described.

	YES	NO
1. When given an assignment, do you like to have all the details spelled out?	( )	( )
2. Do you think that, by and large, bosses are bossier than they need be?	( )	( )

3. Would you say that initiative is one of your stronger points? ( ) ( )

4. Do you feel a boss lowers himself by palling around with his subordinates? ( ) ( )

5. In general, would you prefer working with others to working alone? ( ) ( )

6. Would you say you prefer the pleasures of solitude (reading, listening to music) to the social pleasures of being with others (parties, get-togethers, etc.)? ( ) ( )

7. Do you tend to become strongly attached to the bosses you work under? ( ) ( )

8. Do you tend to offer a helping hand to the newscomers among your colleagues and fellow workers? ( ) ( )

9. Do you enjoy using your own ideas and ingenuity to solve a work problem? ( ) ( )

10. Do you prefer the kind of boss who knows all the answers, to one who, not infrequently, comes to you for help? ( ) ( )

11. Do you feel it's OK for your boss to be friendlier with some members of the group than with others? ( ) ( )

12. Do you like to assume full responsibility for assignments, rather than just do the work and leave the responsibility to your boss? ( ) ( )

13. Do you feel that "mixed" groups—men working with women, for example—naturally tend to have more friction than unmixed ones? ( ) ( )

14. If you learned your boss was having an affair with his secretary, would your respect for him remain undiminished? ( ) ( )

15. Have you often felt that "he travels fastest who travels alone"? ( ) ( )

16. Would you agree: a boss who can't win your loyalty shouldn't be boss? ( ) ( )

17. Would you get upset by a fellow worker whose inability or ineptitude obstructs the work of your group? ( ) ( )

18. Do you think "boss" is a dirty word? ( ) ( )

Followership Test

The questions below can reveal to you in approximate terms the type of leader you tend to be. Some of the questions you will be able to answer offhand. A few may require careful thought. But answer all the questions, and answer them as honestly and accurately as possible. Where the question asked has no ready answer from your experience, indicate what you believe you would do or think in the situation described.

YES NO

1. Do you enjoy "running the show?" ( ) ( )

2. Generally, do you think it's worth the effort to exlain to subordinates the reasons for a decision or policy before putting it into effect? ( ) ( )

3. Do you prefer the administrative end of your leadership job—planning, paperwork, and so on—to supervising or working with your subordinates? ( ) ( )

4. A stranger comes into your department and you know he's the new employe hired by one of your assistants. On approaching him, would you first ask his name rather than introduce yourself? ( ) ( )

5. Do you keep your people up-to-date on developments affecting them? ( ) ( )

6. Do you find that in giving out assignments, you tend to state the goals, leave methods to your subordinates? ( ) ( )

7. Do you think that it's good common sense for a leader to keep aloof from his people, because in the long run familiarity breeds lessened respect? ( ) ( )

8. Comes time to decide about a group outing. The majority prefer to have it on Wednesday, but you're pretty sure Thursday is better for all concerned. Would you put the question to a vote rather than make the decision yourself? ( ) ( )

9. If you had your way, would you make running your group a bush-button affair, with personal contacts and communications held to a minimum? ( ) ( )

10. Do you find it fairly easy to fire someone? ( ) ( )

11. The friendlier you are with your people, the better you can lead them. Correct? ( ) ( )

12. After considerable time, you dope out the answer to a work problem. Your assistant promptly pokes it full of holes. Would you be annoyed that the problem is still unsolved, rather than become angry with the assistant? ( ) ( )

13. Do you agree that one of the best ways to avoid problems of discipline is to provide adequate punishments for violations of rules? ( ) ( )

14. Your way of handling a situation is being criticized. Would you try to sell your viewpoint rather than state that, as boss, your word is final? ( ) ( )

15. Do you generally leave it up to your subordinates to contact you, as far as informal day-to-day communications are concerned? ( ) ( )

16. Do you expect subordinates to feel personally loyal to you? ( ) ( )

17. Do you favor the practice of appointing a committee to settle a problem rather than stepping in to decide on it yourself? ( ) ( )

18. Some experts say differences of opinion within a group are healthy? Agree? ( ) ( )

Scoring

To get your score, follow this procedure for each test:

a. Ring all the question-numbers below which you answered "Yes."

Leadership

I. 1, 4, 7, 10, 13, 16
II. 2, 5, 8, 11, 14, 17
III. 3, 6, 9, 12, 15, 18

Followership

I. 1, 4, 7, 10, 13, 16
II. 2, 5, 8, 11, 14, 17
III. 3, 6, 9, 12, 15, 18

Continued on Page 90

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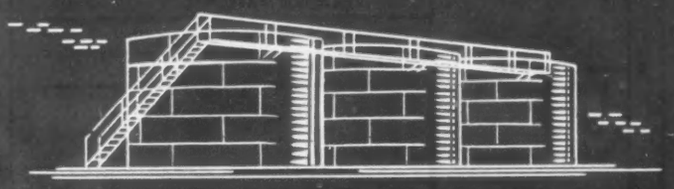

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CARBON MANGANESE SUCKER ROD
For heavy pumping duty, mildly corrosive crude

NORRIS TYPE 35
NICKEL CHROMIUM MOLYBDENUM ALLOY SUCKER ROD
For medium to heavy pumping duty, medium corrosive crude

NORRIS TYPE 40
NICKEL MOLYBDENUM ALLOY SUCKER ROD
For heavy pumping duty, medium corrosive crude

NORRIS TYPE 50
HIGH NICKEL MOLYBDENUM STEEL SUCKER ROD
For heavy pumping duty, severely corrosive crude

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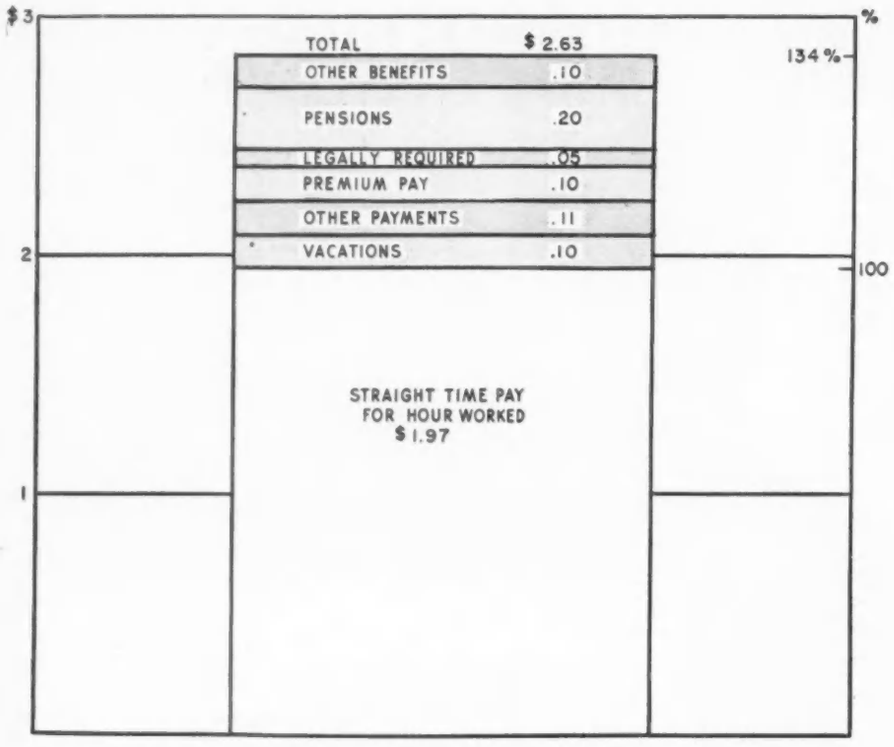

What Does One Hour's Work Cost the Petroleum Industry?
An hourly wage rate of $1.97 builds up to $2.63 when employe benefits are considered

Employe Benefits Must Be Reasonable to Be Safe

• Interests of workers as well as employers are best served by holding costs of fringe benefits safely within productive income.

• Costs of extra payments are heavy in the oil industry and any increases should be studied closely.

By LEE LAIRD,
Standard Oil Company of California, San Francisco

THE OIL INDUSTRY is paying out $1178 per year per employe for fringe benefits. These include pensions, insurance premiums, compensation, savings and stock purchase plans, premium pay, payments for vacations and other time not worked, and other benefits, all being over and above the regular straight time pay at the established hourly rates.

Oil's fringe benefits are among the highest for any U. S. industry. They contrast with $451 per year per employe for the textile products and apparel industry, at the other extreme of the range for different industries. Oil's fringe benefit costs had risen to 28 percent of payroll in 1953 from 18.7 percent in 1947.

The oil industry's costs of employe benefits are already high by comparison with those in other lines. Yet it is meeting demands for still more benefits. It is essential, in these circumstances, that the industry henceforth give serious study to proposals for any appreciable further increases.

If workers are to have assurance that the fringe benefits can be maintained, the costs of the benefits must be held safely within productive income or earnings.

How Costs Compare. The U. S. Chamber of Commerce made the following findings in a recent study:

- Fringe payments varied widely among the 594 reporting manufacturing companies, ranging from less than 6 percent to more than 55 percent of payroll. (This last was a petroleum company whose payments were more than $2700 per year per employe.)

- The average payment was 16.8 percent of payroll, 31.5 cents per payroll hour, or $667 per year per employe.

- By industries, the average payment ranged from 14.3 percent for pulp, paper, lumber and furniture to 24.5 percent for petroleum companies. Two petroleum companies reported costs of more than 40 percent.

These figures indicate the importance of fringe benefits. They are an important part of your payroll and should be recognized as such. In fact, the wage rate is no longer a measure of the cost of an hour of work. One very important item is for time not worked.

In the case of the writer's own company, benefits included as payroll items amount to almost one-half of the total benefits expense. This brings up a major point, namely, that the percentages cited above do not reflect the true burden of fringe benefits based on hours actually worked.

What does an hour of work actually cost?—Based on the U. S. Chamber report, it is possible to estimate what an hour of work actually costs. Say your hourly rate is $1.97 and your employe or fringe benefits are the average for the petroleum industry. From Figure 1 it may be seen that the total is $2.63 for that hour of actual work. That is slightly more than one-third more than the $1.97 hourly rate.

What is the trend in fringe benefits costs?—

The September-October, 1954, issue of the *Harvard Business Review* reports results of its survey on fringe benefits in the article "Big Costs of Little Fringes." Some of its highlights are as follows:

"Of the 400 hand-picked companies questioned, only 162 were able to provide sufficiently detailed answers to the 31 basic questions to warrant inclusion in the over-all statistical analysis."

"The crux of the accounting problem facing most of these managements is the fact that very few companies maintain a breakdown by component employe groups showing the cents-per-hour relationship between fringe costs and actual productive hours worked."

"The two main factual findings derived from our survey are:

"The total cost of fringe payments per productive hour worked had reached 40.99 cents by the beginning of 1953.

"Undoubtedly, during the 18 months which have intervened since the commencement of our study, the figure has increased further. This is corroborated not only by outside evidence, such as the terms of new labor contracts signed, but also by the tabulations of several respondents who were able to supply full 1953 figures. Our best guess would be that another 2 or 3 cents has been added in this time.

"This 40.99 cents figure, corresponding to 25.36 cents in 1948, represents a rise of more than 60% during the five-year period 1948-1952."

The above article quotes an executive warning that "one great danger about fringe benefits—as far as management is concerned—is that a considerable number of them have been adopted through expediency rather than on a basis of cool appraisal."*

The above indicates how these fringe benefits have been increasing fairly rapidly for the last several years. Pressures are present for further increases. The unions are currently demanding among other things that employers set up medical and hospital plans, further insisting that the employer pay the entire cost not only for the employe but for the employe's family as well.

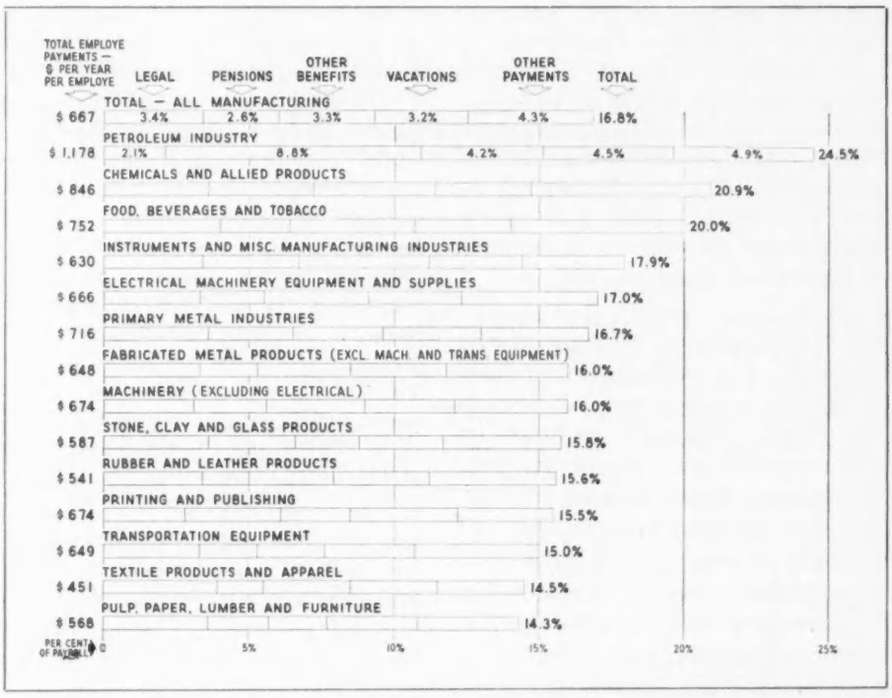

Figure 2. Fringe payments as percent of payroll by type of payment and industry groups, 1953.

Should Employer Bear Whole Load?—This demand poses some serious questions. Employers over the past 15 years have greatly increased the number of their employe benefit plans, as well as the generosity of plans which they already had. Whether this has been done through collective bargaining pressures or voluntarily is not important. But what is important is the already high cost of employe benefits and the still heavy demands for more of them.

The first question is: How much in the way of benefit costs can be paid safely out of productive income?

The answer is quite as important to employes as to employers, because employe benefits are no more secure than the employer's capacity to support them.

Some companies with old established plans have set aside funds to meet future liabilities. But many who have recently acquired expensive benefit plans have not been able to do so. They are paying out of current earnings and could be forced to default if earnings fell off appreciably.

Several phases of hospital and medical plan insurance are still in the experimental stage. This includes major medical expense, hospital and medical plan for annuitants and extending the same coverage to dependents as extended to employees. Theoretically, the ideal is complete insurance for all medical, hospital, and surgical care. Many feel this is not practical at a reasonable cost. And, certainly, cost of hospital and medical care has been increasing steadily for the last few years. Some of the items mentioned could double or triple present cost. So, just where is the end?

Another question arises: Should the employer assume any medical and hospital cost for an employe's family? Is this an employer responsibility or does it belong to the man who has a family?

Two years ago the manager of our company's Labor Relations department was an advisor to the American

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employer delegates to the Petroleum Industry Committee Conference at The Hague in Holland. There he heard frequent reference to the American wage system as a "clean" wage system. By that was meant the employe gets his complete earnings in money, whereas in many parts of the world wages are paid out in the form of money and social services.

These social services are particularly applicable in underdeveloped countries. For example, an oil company may locate a new oil field in the jungle. To move workmen in, the companies must provide housing, cookhouses, hospitals, medical care, etc., because none are available. As the field develops, the families move in and also have to be provided for. The need for streets, sanitation, recreational facilities, even schools and churches, police protection and transportation facilities has to be met by the employers. Company stores have to be provided.

But, once these services are provided, it becomes almost impossible to get rid of any of them. The governments are slow about moving in to assume the usual municipal functions. No medical practitioner can move in because medical treatment is free. The small enterpriser cannot compete with the low prices of the company stores which are at company cost. And then follows the demand for more and more services, always at company expense.

For example, he listened to demands for "snack bars," an ambulatory dispenser of soft drinks, cookies and similar refreshments, one to every 50 workmen on the job; medical care for all relatives resident with the family; and further reduction in store prices by having the company not only assume the investment costs but the entire operating costs as well. There was also mentioned the desirability of double time pay while on vacation. Meantime, there are the usual insistent demands for higher wages. Wages admittedly are not comparable with this country's, but neither is the production of the workman.

This trend has become of increasing concern to employers in foreign countries because continued extension of it can drive them out of business.

Are the employers in this country possibly experiencing the first of a set of demands for so-called social services in addition to the present "clean wages" already the envy of the world? Medical and hospital protection is already available to employes' families at favorable rates. Is not having the employer pay the family premium merely a matter of getting something cheaper? If medical and hospital services can be forced upon the employer, why not other things? The reasoning is the same. Our company's labor relations manager knows of no union that has yet advanced the argument that family medical service is the employer's responsibility. The main argument is that someone else has already done so; if he can afford it, why can't you?

There are other problems associated with these social services. It plants the employer right in the middle of the employe's intimate family life and becomes a source of new and complicated personal problems. This has already given rise to a general complaint which he also heard expounded very forcefully at The Hague. The union representative arose to say, "Look here, Mr. Employer, you are making slaves of your workers. Everything around them but the air they breathe belongs to you. You own everything. The employe has no private life. Turn all these facilities over to the union and let us run them. You pay the costs, of course."

The present burden of fringe benefits, particularly in the petroleum industry, is so large that very serious thought and analysis should be given before there is any appreciable increase in present fringe benefit costs. We should carefully consider these two questions: (1) how much in the way of benefit costs can be paid safely out of productive income; and (2) should the employer assume any medical and hospital cost for an employe's family. Is this an employer responsibility or does it belong to a man who has a family?

Use the Readers' Service blue post cards on the last page of this issue for more information on advertised products.

How to Lead Engineers

Continued from Page 86

b. Count the "Yes" answers you've indicated for rows, I, II and III.

c. Fill in the three totals in the columns below.

Leadership

I.—autocratic tendency
II.—democratic tendency
III.—free rein tendency

Followership

I.—autocratic tendency
II.—democratic tendency
III.—free rein tendency

Evaluation

The following analysis applies to both your leadership and followership scores. In general, there are four possible types of scores:

High scores. Any category in which you scored from 4 to 6 "yes" answers is one toward which your inclinations are strong. Let's say, for instance, that your leadership score read like this: autocratic—5; democratic—3; free rein—1.

Your autocratic leadership tendencies would tend to be quite pronounced. That is, you would have a decided preference for an autocratic superior.

Low scores. Another possibility is that your score didn't go about three "yesses" in any of the categories. Here's a followship score of this kind: autocratic—2; democratic—2; free rein—1.

Behind low scoring you're likely to find an individual without strong feelings about working under any of the three types of leadership. He would do almost as well under a boss using any one of the three methods.

Balanced scores. A particularly interesting type of score is one of this kind: autocratic—3, democratic—3, free rein—3.

Evenly distributed scores generally reveal a personality sympathetic to all three methods. People who make this kind of score have a well-proportioned personality. It's a desirable balance. Under ordinary circumstances they will have less of a problem in adjusting to the realities of the superior-subordinate relationship.

Such a score, however, is not usual. The reason is that preference for the autocratic and free rein methods often require emotional outlooks which are directly opposed to one another. Such conflicting elements seldom are found within the personality of a single individual.

In most cases, balance is less perfect.

Let's say your scores were slightly off balance—3, 2, 1, for example. Your autocratic preference is there all right, but it's not too pronounced. Chances are, people with scores of this kind would find little more difficulty in functioning under a free rein leader than an autocratic one.

Unbalanced scores. A score that is high in one category, low in the other two, has clear-cut implications. Take this possibility, for example: autocratic—0; democratic—6; free rein—1.

It's a safe bet that a person getting this kind of score has a strong preference for democratic leadership. In addition, he has tendencies away from the other two types.

Rig Safety — a Job for Management

A good safety program must begin . . . and end . . . with management, speakers agree at AAODC's Tenth Annual Safety Clinic. Standardized training program suggested.

WHO IS ULTIMATELY responsible for rig safety?

They put that question last month to the men who shove the iron—the roughnecks, the drillers, the toolpushers—and the answer came back like this:

"Nobody but management itself."

The sentiment was adopted and the answer was echoed by safety directors and contractors—more than 150 of them—who attended the Tenth Annual Drilling Safety Clinic of the American Association of Oilwell Drilling Contractors at Dallas.

The placing of responsibility for safety upon management came out of a panel discussion among toolpushers, safety directors, drillers and roughnecks, led by John W. Baldwin of Humble Oil & Refining Company, Midland.

What, in the minds of these men who make the hole, is the big reason people get hurt on a rig?

"Insufficient or improper training" was a frequent answer—and the observation was repeatedly paraphrased in more formal talks.

W. P. Clements, Jr., vice president of Southeastern Drilling Company of Dallas, a firm whose once-poor safety performance has been so sensationally bettered as to earn National Safety Council recognition for 1954, revealed these figures from his records:

- Two-thirds of those injured had been with the company less than six months.
- One-half of those two-thirds were people who had been with the company less than 30 days.

"I can say," declared Clements, "that of the 35 hired this month, 11 or 12 will get hurt."

More evidence of the vulnerability of inexperienced men came from Warren A. Hirsch of Delta Gulf Drilling Company, Houston. Quoting from past records of his company, he declared that:

- Sixty-one to 70 percent of injuries happened in the first 2 to 12 weeks.
- Forty-eight percent of those injured were from 20 to 30 years old; 30 percent were 31 to 40 years old; and only 21 percent were 41 and over.

Solution to the problem, Baldwin's panel agreed, is up to management, which must exercise more care in hiring and training.

A greater departure than ever before must be made from now-obsolete hiring procedures, typified in the subsequent description by Hirsch as poking your head into the nearest bar and yelling: "All bodies warm and upright! Let's go to the rig!"

As for training, an unanswered question from the panel was: Why doesn't the AAODC set up a pattern for work procedure that could be used on every rig? Then, when a man's rig was stacked, he could move over to another without exposing himself to unusual hazards in his new job.

Promote from within. So closely related to job training as to be a part of it are promotion practices. By promoting from within, it was brought out by Baldwin, morale is increased, turnover lessened. And, as John S. Jackson, safety director for Rowan Drilling Company of Fort Worth had said earlier, "Who in this room would dare dispute the fact that when you have a crew of men on your rig with little turnover and high morale they invariably have the best safety record? Not only this, but they normally get the most hole in the shortest length of time."

A major avenue to lessening turnover and improved morale, said Jackson, is an open line of communications—a management responsibility. Of the several communications methods, Jackson and others laid heavy emphasis on meetings. The Rowan safety director cited three types:

1. Management meetings, at which the progress of the safety program is discussed, new ideas debated, new policies adopted.

2. Toolpushers' meetings, at which the safety program and management's policies are discussed. ("I think that all of you are aware of the fact that the toolpusher is the key member of the team which makes or breaks a safety program," Jackson declared.)

3. Crew meetings, of which there are two sorts—on the rig floor, and the "mass-type," attended by management and led by the toolpusher.

Management's job. Management's role in rig safety was described by J. E. Harrington, safety director for General Petroleum Corporation of Los Angeles, as follows:

- Management must really believe in the importance of industrial safety.
- Management must recognize that an industrial safety program will have to satisfy pressures from government, customers, employes, stockholders and the general public.
- Management must recognize its responsibility for the development of spirit and attitude at all levels of personnel.
- Management must live as it preaches, by providing funds for adequate safety personnel, adequate safety training procedures and adequate safety equipment.

And is management doing all these things? Not always, declared W. W.

Continued on Page 104

Supply-Demand Balance Is Essential

Says L. F. McCOLLUM, President, Continental Oil Company, Houston

THE LAW of supply and demand and the price mechanisms which go with it are an integral part of the competitive system. It is competition and a free interplay of forces of supply and demand that made the U. S. a great nation. Therefore all should be supporters of this law and opponents of arbitrary controls that would interfere with its operation.

Everyone has to live under the dictates of the law of supply and demand. But it is the task of enlightened management to strive constantly to keep both sides of the equation in balance. If industrial statesmanship is made the basis of policies in the petroleum industry, the law of supply and demand becomes an indispensable ally, furthering the expansion of the industry and increasing the industry's contribution to the well-being of the nation.

To be discussed here are the application of the law of supply and demand to the petroleum industry and the role which management decisions play in keeping both sides of the equation in proper balance.

As regards crude oil, the supply side depends on four main factors.

- Ability to find new reserves.
- The rate at which underground reserves are converted into productive capacity.
- The rate of drawing upon the availability so created in actual production of crude oil.
- Volumes of crude oil imported to supplement domestic supplies.

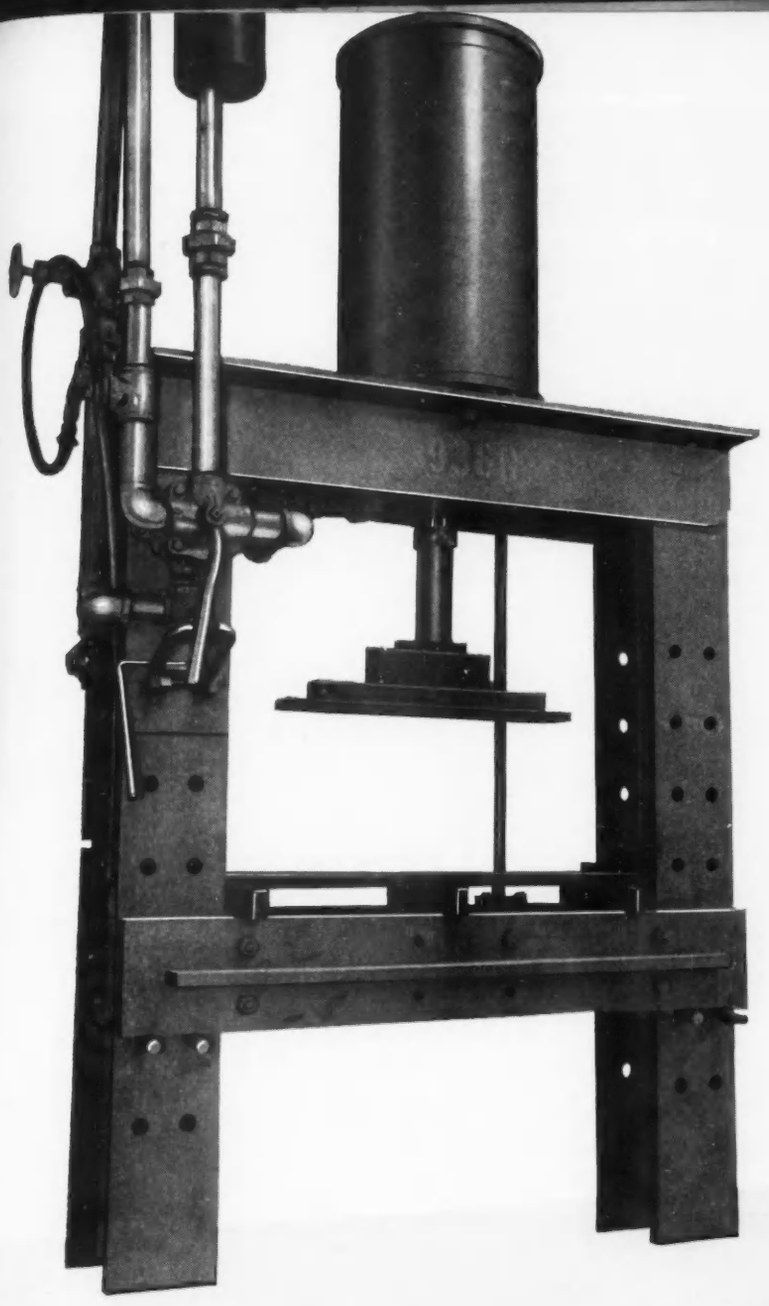
The extent to which these factors in supply can be influenced by management varies considerably. In exploration, management's opportunities to influence supply are restricted because the risk and success factors cannot be accurately estimated. Different and lesser restrictions exist in producing crude under state conservation laws. But as to imports and refinery operations, management has complete freedom of action. This freedom carries with it a great responsibility.

Management's responsibility is not confined to the supply side of the equation. It also extends to the demand side. Enlightened management can and does stimulate demand for its products. Oil industry management has made available large volumes of petroleum products at reasonable prices. And it has continually stimulated demand through meeting changing consumers' preferences in terms of quantities, qualities and prices.

Specific problems now confronting oil industry management fall into two parts.

- Those arising from the current situation.
- Those concerned with longer term outlook.

As regards the current situation, the oil industry is affected more than many other industries by seasonal variations in demand. Seasonal swings in demand have become accentuated as more consumers have turned to oil for home heating. The peak in demand for all products is usually reached in January, and the low point almost invariably in May. In 1954, total demand in January was 8,940,000 barrels daily, and in May was only 7,190,000 barrels daily. So, a year ago the seasonal decline in demand over a span of a few months was as much as 1¾ million barrels daily, or 20 percent. Back in the early postwar years, total demand was maintained on a much more even keel, partly because declines in distillate demand were offset by sharp increases in gasoline consumption. In 1946 the shrinkage in demand from the peak to the low point was only 65,000 barrels daily, or 1.2 percent, and in 1947, 339,000 barrels daily, or 5.7 percent. With motor transportation increas-



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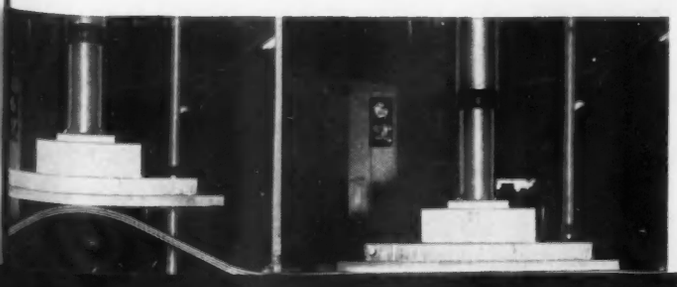

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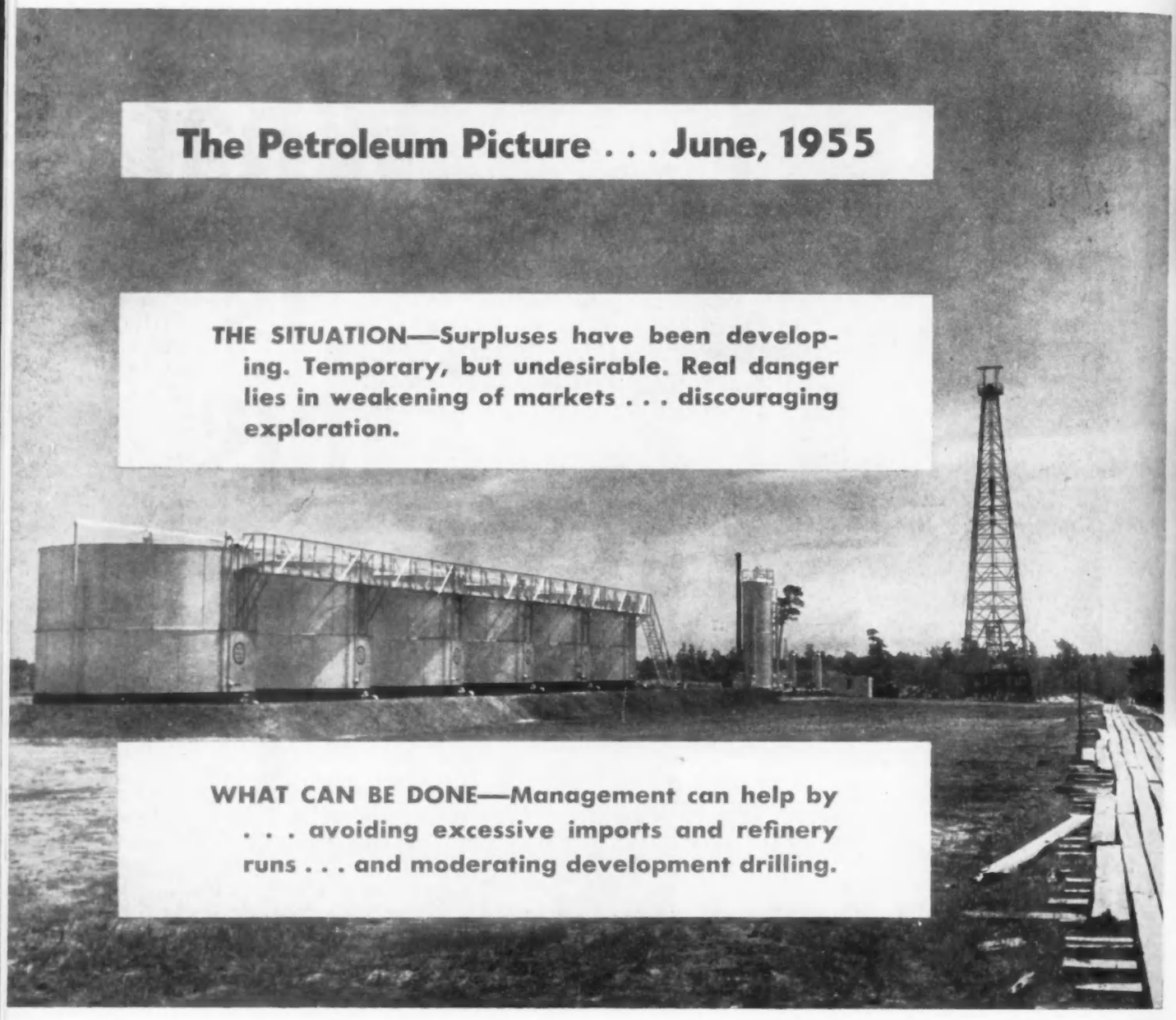
The Petroleum Picture . . . June, 1955
THE SITUATION—Surpluses have been developing. Temporary, but undesirable. Real danger lies in weakening of markets . . . discouraging exploration.
WHAT CAN BE DONE—Management can help by . . . avoiding excessive imports and refinery runs . . . and moderating development drilling.

ingly important and roads improved, the mileage driven by passenger cars, trucks, and busses, no longer fluctuates violently between summer and winter. So, by furnishing the consumer with reasonably priced space heating and propulsion fuels, the oil industry created a new problem for itself—abiding by the law of supply and demand on a short-range as well as long-range basis.

Figures cited apply to the country as a whole. In areas with relatively mild climate, the oil industry's seasonal problem is not quite as acute. But over-all industry figures understate the seasonal swings in demand in areas of heavy distillate consumption. Clearly then, there is an urgent need for each refinery unit in this country to adjust its runs to the shrinking levels of total demand in the second quarter of the year and to increase runs later in the year when demand starts expanding. Similarly, yields of various products need adjustment from time to time to meet changes in the seasonal pattern of demand. The extent of these adjustments will vary by areas, and no uniform formula can be prescribed for the industry as a whole. Appraisal of what adjustments are proper rests with the management of individual units. But whether the aggregate of these individual decisions was right or wrong can be appraised by examining the trends in inventories of two major products, gasoline and distillate.

This year is no exception to conditions described. Total demand for the second quarter is expected to be some 1 million barrels daily below demand in the first quarter. Several oil companies recognized the nature of the seasonal problem and announced that substantial reductions would be made in the level of their refinery runs during the second quarter.

Gasoline inventories turned out to be much too heavy by mid-year in 1954. This year these inventories accumulated at a faster rate than a year ago. Consequently, gasoline inventories now are definitely on the high side. However, companies in California have been watching the supply-

REED *SuperShrink-Grip* TOOL JOINTS GIVE NEARLY TWICE THE AVERAGE FOOTAGE IN CALIFORNIA

W. G. Simpson, Drilling Superintendent, Clyde Hall Drilling Company

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March 12, 1955

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By W. G. Simpson

W. G. Simpson

WGS:hp

This 240,000-foot service life of Reed Tool Joints is nearly twice the usual life of tool joints in California where 4½" hardfaced tool joints normally can be used for only 100,000 to 175,000 feet of hole.

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demand situation a little more closely than was the case with the rest of the country, and this is good management.

Excess inventories doubtless will be worked off, as on many previous occasions. We do not have too much oil in this country in the long run. We merely have too much of certain refined products, temporarily. Worry about a temporary oversupply is not justified except for two things:

- It can be easily avoided if companies pay more attention to the law of supply and demand.
- If the condition of oversupply becomes protracted, the resultant dislocations in markets for products may seriously affect the industry's ability to find and develop new reserves.

The flow of funds into exploratory and development effort must come from the sale of refined products derived from crude oil. If this flow is materially impaired because products have to be sold on a break-even basis or at a loss, the availability of future supply of oil may be adversely affected.

Longer range trends in supply and demand. In recent years, U. S. crude oil producing capacity and refining capacity have been growing at more rapid rates than demand. As a result, there are now substantial reserve capacities in both production and refining. During the period of 1951-1954, U. S. productive capacity has been increasing at an estimated average annual rate of 6.5 percent, and refining capacity at an average annual rate of 5.3 percent. The average annual increase in total demand during the past four years was 4.4 percent. Creation of reserve capacity in production and refining has been considered vital to national defense and has been encouraged by the government.

It has not been subsidized, since none of the expansion was supported by government funds. A tax policy allowing accelerated depreciation on all or a part of certain petroleum refining and transportation facilities considered vital to national defense has encouraged a greater expansion of capacity than might otherwise have been undertaken. But no tax incentives in addition to those which have already existed for a number of years were made available to the exploration and production segments of the business.

It looks as if the U. S. has too much productive capacity now, and some people think there may be too much for a protracted period in the future. Is the latter conclusion correct? Examine the trends in underground reserves, from which actual and potential production must come. Has exploratory effort during recent years resulted in additions to reserves large enough to parallel expansion in productive capacity and in demand? Unfortunately, the answer is "no" on both counts.

Reserves versus productive capacity. U. S. productive capacity has grown during the 1951-1954 period at an average rate of 6.5 percent per annum. Reserves have grown at an average rate of only 4.2 percent per annum. The disparity was accentuated in 1954, when the annual rate of growth of reserves declined to 2.8 percent, and growth in productive capacity increased to 7.5 percent. In part, acceleration in rate of growth in current availability of oil was due to secondary recovery projects and technological improvements in production practices. But the major factor was concentration of drilling effort in development type wells at the expense of exploratory drilling. From 1953 to 1954, the number of development wells completed increased by 11.5 percent by contrast, the increase in exploratory drilling was less than 2 percent. In 1954 the industry drilled 3.8 development wells for each exploratory well completed. During the preceding three years, the ratio averaged around 3.1 to 1.

How do U. S. reserves compare with changes in demand? In the last full prewar year, 1940, U. S. reserves of petroleum liquids were 14.3 times as great as the then current demand. In 1946, the ratio declined to 12.1. There was a further decline in subsequent years, and in 1954 the ratio was only 11.7.

Reserves are here purposely related to demand rather than crude oil production. In preWorld War II days there was not much difference between total demand and domestic production. But since 1946 there has been an increasing gap between the two, caused by rapidly growing imports of foreign crude oil and refined products. In 1946, total imports constituted 8 percent of U. S. crude production and 7.1 percent of total demand. In 1954, imports were equivalent to 16.6 percent of domestic production and 13 percent of total demand. In volume, imports expanded from 377,000 barrels daily in 1946 to 1,052,000 barrels daily in 1954.

Development of new reserves and rapid expansion in production abroad, particularly in the Middle East, had another effect on the domestic situation. Crude oil and products from foreign sources have been backing out U. S. exports of petroleum to an increasing extent. This naturally contributed to a slower rate of growth in total demand.

Two problems have arisen: (1) we have been increasing short-range availability of oil from domestic sources at a more rapid rate than results of exploratory effort justified; and (2) to make matters worse, we have been bringing in foreign oil in quantities which have been generally recognized as being excessive.

The components of the supply side of the equation which have been mentioned, namely the injudicious use of domestic reserve capacity in production and refining and excessive imports, need careful appraisal and watching. They are influenced by management decisions. Oil industry management has done an outstanding job in stimulating demand for its products on a quality and price basis and in discovering new reserves sufficient to meet demand. But the long-range rate of growth in demand may ultimately outdistance ability to find and develop new reserves in the U. S. These reserves are finite and are becoming increasingly difficult to discover. The oil industry therefore must pay particular attention to a proper balance in supply and demand and avoid temporary gluts, realizing that if not checked in time, they may cause a long-range famine.

ACKNOWLEDGMENT

From an address before the division of production, Pacific Coast district, American Petroleum Institute, Los Angeles, April 28, 1955.

—The End

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What Texas Legislature Did About Oil

• Lawmakers embattled over taxes. Chances of 2-cent hike in gasoline tax dimmed.

• Biggest spending bill in Texas history is enacted.

• Further tax increase for the oil producer considered unlikely.

• House approves higher levies on natural gas production. Final decision in doubt.

• Labor control bills pass despite vigorous protest from union leaders.

• New leasing law and trucking law affect the oil industry.

THE TEXAS LEGISLATURE was embattled over taxes late last month after disposing of new laws on labor, compensation, pollution, leasing and other problems of major concern to oil.

Gov. Allan Shivers wanted a 2-cent increase in the gasoline tax, raising it to 6 cents a gallon. This would bring in an estimated $45 million a year for highway improvements and $15 million for schools.

The House rejected a 2-cent gasoline tax boost in April, favoring a 1-cent increase. However, sponsors of the 2-cent increase were saying late last month that more House members now would vote for the larger tax, which was backed by city and county officials, the Highway Commission and the state's biggest organization of truckers.

Chances of the 2-cent raise being enacted were further dimmed by Senate committee action.

Spending. Legislators wrote the biggest spending bill in Texas history. The total for two years will be more than $1525 million. This is $116 million more than the state government cost for the 1953-1955 period. Increases went mostly for education, the result of increasing enrollment.

The state needed about $60 million of new taxes to pay these expenses, not counting the highway program. The remainder of the $116 million increase will come from existing sources.

Production problems. It seemed certain that the oil producer would not draw any tax increase. Industry spokesmen like Andrew M. Howsley, vice president and general counsel of Texas Mid-Continent Oil and Gas Association, told the Legislature that the Texas oil producer has enough problems already, without higher taxes.

Howsley pointed out the effect of increasing imports and mounting national inventories of crude and products. Exploration is becoming more expensive and less productive in Texas, the legislators learned.

While the Legislature was in session, proration cuts by the Railroad Commission reduced quotas for Texas by more than 350,000 barrels a day. If maintained for a full year, this would shrink expected tax revenues by $20 million.

Gas tax. The House voted for higher taxes on natural gas production, but it seemed doubtful this would be the final verdict. Led by such organizations as Texas Mid-Continent and the Texas Independent Producers and Royalty Owners Association, opponents insisted that the Legislature had promised to let the gas tax decline.

In 1954, the Legislature jumped the tax from 5.72 to 9 percent of value at the well to raise money for teachers' salaries. This law calls for automatic reduction of the rate to 8 percent on September 1, 1955, and to 7 percent on September 1, 1956.

The House favored keeping the rate at 8 percent permanently, but the Senate appeared to take a dim view of the idea.

Labor. The Legislature passed two labor control bills by Sen. George Parkhouse of Dallas, over the vigorous protest of union leaders.

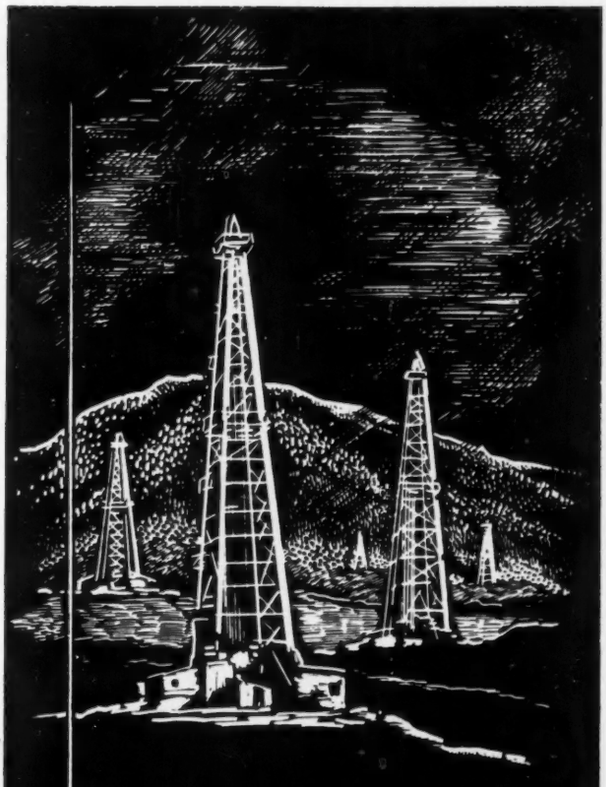
The biggest blowoff came on Senate Bill 45, the so-called "anti-coercion law." Gov. Shivers recommended the legislation in his first message to the Legislature, and he stirred the House into approving it with a message in May when it appeared the bill had bogged down.

The anti-coercion bill outlaws strikes and picketing unless a majority of employes at the place show they favor union representation. The Parkhouse bill would let the district court supervise the election, which would be held within 20 days after the lawsuit is filed.

The presiding judge can call a judge from outside the county to handle the case. This is intended to get away from local political pressure.

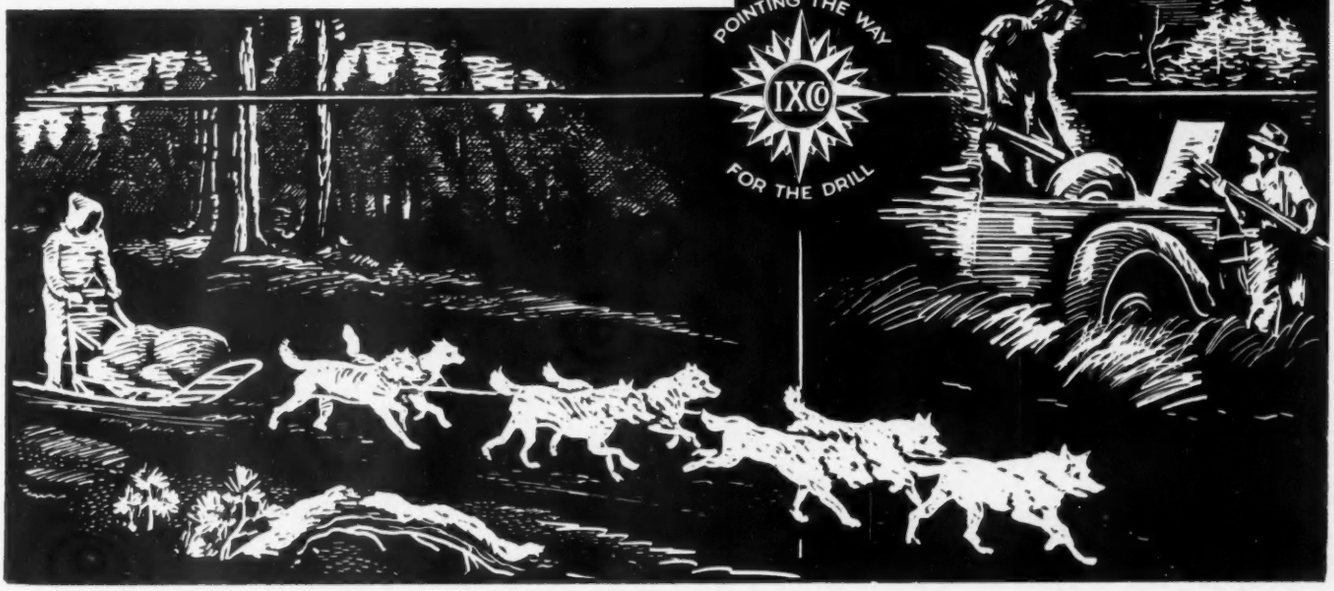
Mass picketing. The other Parkhouse bill would extend the venue

A. D. Dunlap is typical of Independent personnel. Dunlap has been with IX for 20 years. He has spent most of these years in the field, working every job on a surveying crew from helper to party chief. Now Supervisor and Manager of IX in Canada, Dunlap's intimate knowledge of seismographic work is proving valuable to clients in this important oil region.



DERRICKS TODAY

Where I.X. Parties Were Yesterday



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statute on injunction cases filed under other Texas labor laws, like those against mass picketing. It would allow filing in the county of the alleged violation, in the home county of any defendant, or in Travis county—if the Attorney General takes an active role.

Compensation. Efforts to pass a new workmen's compensation law were defeated. Members agreed generally that the maximum payment to the totally-disabled should be increased; but they disagreed on how much to pay the partially-disabled and on such points as allowances for attorney fees.

'Waste' Bill. One of the session's biggest struggles concerned efforts to pass an "economic waste" statute to let the Railroad Commission prescribe minimum prices for natural gas in the field. The measure, opposed by major purchasers of gas, was effectively bottled up in the House for almost five months.

Spokesmen for the chemical industry were among those opposing the bill. This group also resisted successfully efforts in both House and Senate to put a tax on chemicals.

Unemployment. A new Unemployment Compensation Act became law. It permits Texans to take advantage of a liberalized federal law. Coverage was extended to all employers of four or more persons, formerly eight or more. Employers also can qualify quicker for a rate reduction based on favorable experience rating.

Apparently headed for final approval was a bill by Parkhouse to ban unemployment compensation payments where the applicant is idled by a strike of fellow-unionists at another plant. This is aimed at situations like that which arose when Dallas Ford assembly plant workers were thrown out of work by a Michigan strike of parts-makers.

A dispute raged over the wording of a provision to permit unemployment payments where the idleness results through no fault of the applicant. The bill is aimed at situations where the applicant for unemployment aid belongs to the same union as the strikers, and is helping maintain the strike with union funds.

Leasing. A new leasing law on University of Texas lands allows extension of the primary term for a year beyond the usual five-year period, if the lessee pays extra to keep the agreement in force while drilling a well.

A three-year extension of leases will be permitted on shut-in gas production, by paying $1200 a year. This is to allow time for developing a field to attract a pipe line or other customer for the gas. Any well on university land can be shut down for 60 days without causing loss of lease, under this bill by Sen. Carlos Ashley of Llano.

Pollution. The anti-pollution law on drilling in offshore areas will be enforced by the Land Commissioner, rather than Game and Fish Commission, under another new law. Rules have been prescribed by the Land Office in the past, on geophysical exploration and drilling on State School Board land. But enforcement was left to the other department.

Among several water bills was one to let the Railroad Commission require bond of drillers, to insure against pollution of fresh water sands. This was well-advanced late in May. Numerous other water proposals also awaited final action more than two weeks past the May 10 deadline.

Trucking. A new trucking law raises from 45 to 50 feet the permissible length of truck-trailer combinations; and another increases all motor vehicle operators licenses by 50 cents a year or $1 for each two years. With the funds received from the license increase, the Department of Public Safety plans to hire another 200 highway patrolmen.

Salaries. The Legislature also approved higher salaries for most top state officials and those in the "junior executive" rank who often found pay more attractive in private industry. The three Railroad Commissioners will be paid $17,500 a year each, compared to the present $10,600. The Chief Engineer, Oil and Gas Division, will receive $12,500 a year, a $2000 raise.

Increased pay is expected to help influence William J. Murray Jr., Railroad Commission chairman, to seek a new term when his present term expires after 1956.

Legal. Three major legal codes were written at the session. A new probate code includes, among other things, a long-sought clarification of mineral lease rights involving guardians.

A new corporation code, designed to encourage incorporation in Texas, permits a firm to be organized for multiple purposes. The old law confined a corporation to one purpose.

—**The End**

Rig Safety

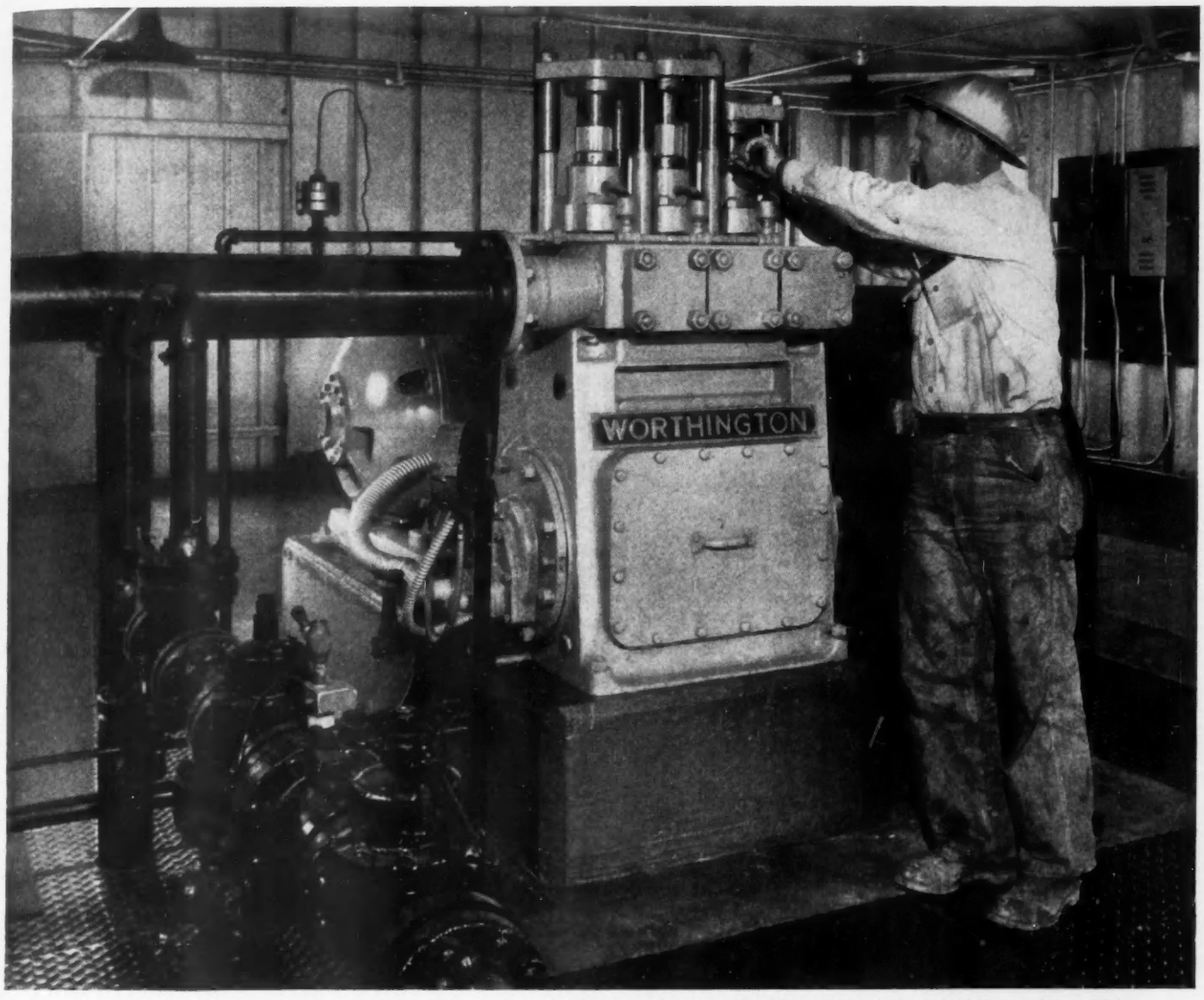
Continued from Page 95

Duncan of Loffland Brothers Company, Tulsa. "Top management in many cases," he said, "has been and remains as hard to sell on safety as the workmen and foremen . . ."

However, he pointed out that drilling industry management on the whole is paying greater homage to the principles of safety, as witness the fact that they have almost universally sold themselves and their crews on proper physical protection, at least. "The crews today," he said, "are just as much men as they were in those (the old) days, but they have accepted safe practices and are now wearing hard hats, safe-toed shoes, goggles and safety belts and enjoying a feeling of personal protection that in the old days did not exist . . .

"All this," he added, "is a far cry from the days when a man used the end of his shirt tail to remove an object from his eye, used tobacco juice as a sterilizing agent on his cuts, and told all his friends that he could eat all that stinking gas they wanted to put out. The new way has paid off for both the man and the contractor through programs developed around the basic AAODC Safety Committee program."

Southeastern's Clements neatly bracketed the clinic's mood with these quotes: "If you have a safety program and top management is not supporting it, the men on the rig will sense it, and when the safety director comes around he's whipped." —**The End**



WORTHINGTON WATERFLOODING PUMP on the job at a large Oklahoma oil field installation. Power for the pump is transmitted by Worthington QD Sheaves and Worthington-Goodyear V-belts.

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It's like a word association test. Mention "waterflooding" and somebody pipes up with "Worthington".

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Take a look at some of the features built into today's Worthington vertical power pumps.

- **INDIVIDUAL VALVE COVERS** — make inspecting and servicing valves quick, easy.
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P.4.2

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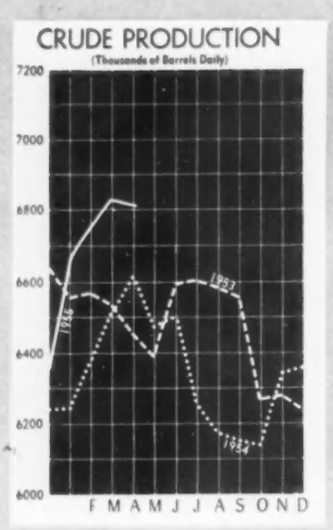
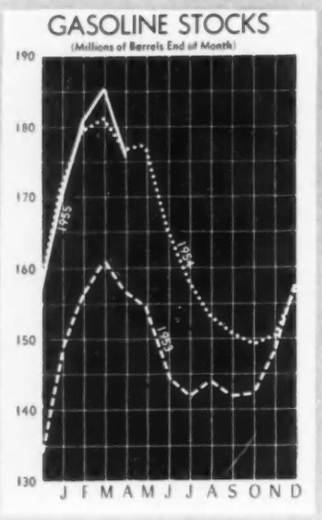
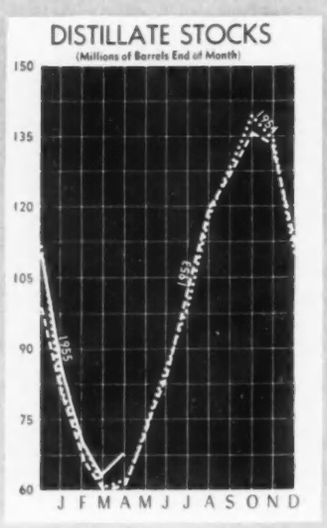
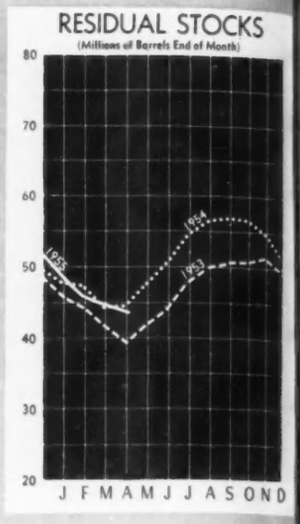
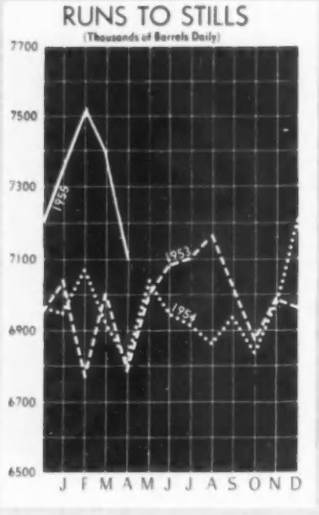
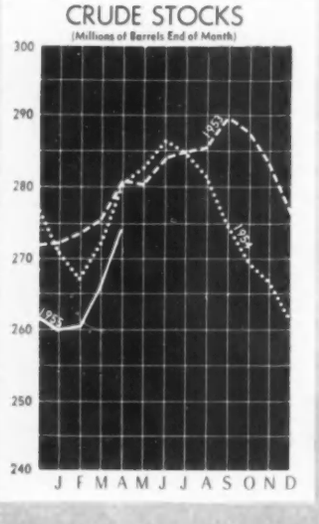












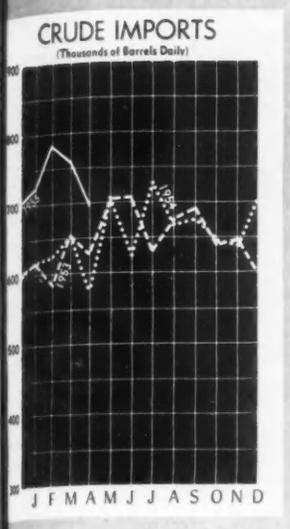
Petroleum Trends in U. S. . . .

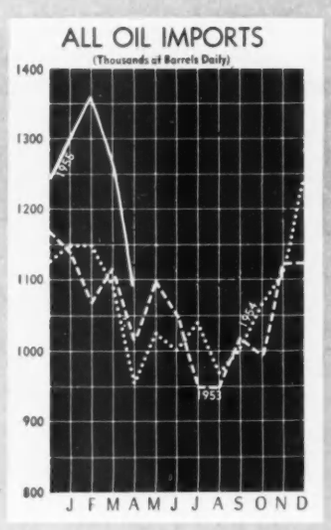
By CECIL W. SMITH, World Oil Staff

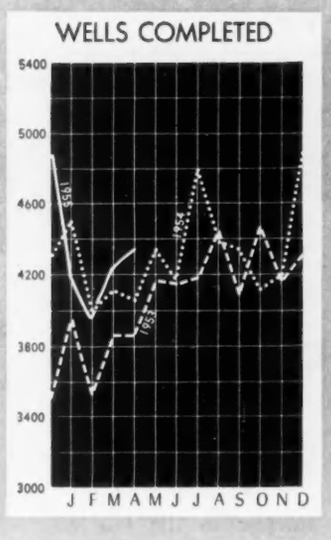
U. S. Crude Production by States

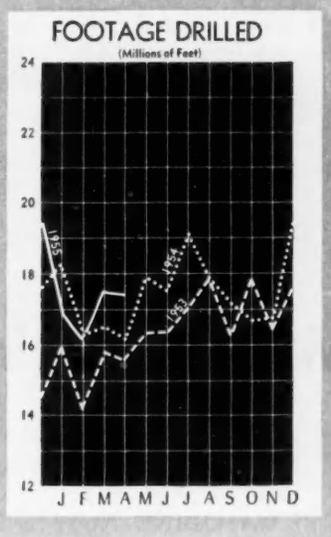
(Thousands of Barrels)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION April, 1955	March, 1955	April, 1954	% Diff. April, '55-'54	TOTAL PRODUCTION First Four Months 1955	1954	% Diff. '55-'54
Alabama	4.2	4.2	4.3	— 2.3	504	543	— 7.2
Arkansas	74.2	73.6	81.5	— 9.0	9,045	9,744	— 7.2
California	974.4	970.4	986.7	— 1.2	116,290	119,182	— 2.4
Colorado	140.4	138.6	106.1	+ 32.3	15,660	11,838	+ 32.3
Florida	1.3	1.4	1.3		157	176	— 10.8
Illinois	217.0	211.2	180.4	+ 20.3	25,472	20,998	+ 21.3
Indiana	28.0	27.7	31.7	— 11.7	3,415	3,881	— 12.0
Kansas	329.5	335.8	336.9	— 2.2	40,422	39,181	+ 3.2
Kentucky	38.5	38.8	38.0	+ 1.3	4,631	4,428	+ 4.6
Louisiana	718.0	710.6	719.5	— 0.2	85,240	84,246	+ 1.2
North Louisiana	114.0	112.0	118.6	— 3.9	13,818	13,873	— 0.4
South Louisiana	604.0	598.6	600.9	+ 0.5	71,422	70,373	+ 1.5
Michigan	32.0	32.3	34.4	— 7.0	3,854	4,051	— 4.9
Mississippi	95.8	95.7	92.9	+ 3.1	11,361	11,247	+ 1.0
Missouri	0.2	0.2	0.2		21	28	— 25.0
Montana	45.2	43.0	35.6	+ 27.0	5,278	4,069	+ 29.7
Nebraska	29.3	28.4	19.3	+ 51.8	3,083	2,252	+ 36.9
Nevada	0.2	0.2			25		
New Mexico	228.0	225.3	201.7	+ 13.0	26,851	24,062	+ 11.6
Southeast New Mexico	226.3	223.8	199.4	+ 13.5	26,587	23,804	+ 11.7
Northwest New Mexico	1.7	1.5	2.3	— 26.1	264	258	+ 2.3
New York	10.9	11.0	9.3	+ 17.2	1,140	1,103	+ 3.4
North Dakota	22.5	29.8	14.0	+ 60.7	3,444	1,765	+ 95.1
Ohio	12.9	11.5	11.2	+ 15.2	1,359	1,283	+ 5.9
Oklahoma	560.4	559.7	564.6	— 0.8	66,113	65,887	+ 0.3
Pennsylvania	20.6	20.6	27.0	— 23.7	2,522	3,191	— 21.0
South Dakota	0.1	0.1	0.1		12	4	+200.0
Tennessee	0.1	0.1	0.1		4	6	— 33.3
Texas	2,940.4	2,969.8	2,850.0	+ 3.2	357,169	327,786	+ 9.0
Dist. 1—South Central	54.4	51.5	42.1	+ 29.5	6,065	4,986	+ 21.6
Dist. 2—Middle Gulf	158.6	159.2	155.7	+ 1.9	18,983	17,759	+ 7.0
Dist. 3—Upper Gulf	467.4	478.0	456.6	+ 2.4	56,704	53,619	+ 5.8
Dist. 4—Lower Gulf-S.W.	249.3	263.2	262.2	— 4.9	30,861	30,445	+ 1.4
Dist. 5—East Central	47.5	49.4	48.5	— 2.1	5,896	5,427	+ 8.6
Dist. 6—Northeast	360.8	369.8	372.6	— 3.2	43,988	42,840	+ 2.7
Dist. 7-B—North Central	141.0	142.9	138.8	+ 1.6	16,956	15,639	+ 8.4
Dist. 7-C—West Central	199.4	194.7	188.2	+ 6.0	22,977	21,767	+ 5.6
Dist. 8—West	967.2	978.0	901.6	+ 7.3	116,307	103,799	+ 12.1
Dist. 9—North	207.4	195.6	194.6	+ 6.6	23,597	22,730	+ 3.8
Dist. 10—Panhandle	87.2	87.5	86.5	+ 0.8	10,376	9,927	+ 4.5
Utah	6.2	6.1	5.3	+ 17.0	698	635	+ 9.9
Virginia	0.1	0.1	0.1		4	3	+ 33.3
West Virginia	7.2	7.0	8.0	— 10.0	806	1,005	— 19.8
Wyoming	283.2	286.8	254.5	+ 11.3	33,102	29,604	+ 11.8
Total United States	6,821.1	6,840.0	6,614.7	+ 3.1	817,682	772,198	+ 5.9









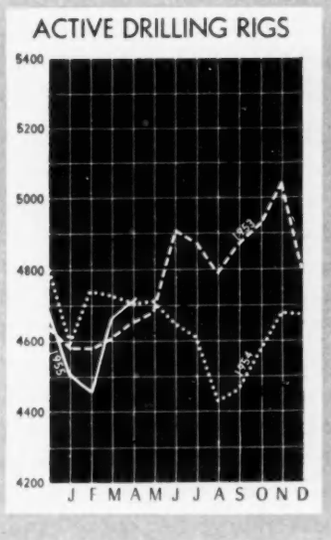
- **Crude production eased slightly**
- **Drilling activity on increase**
- **Refining rates cut sharply**

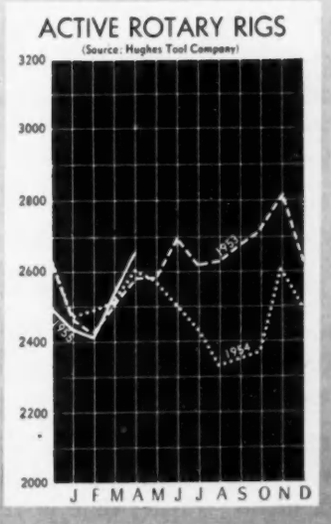
Crude Oil and Refined Products Trends

(Thousands of Barrels)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1953:											
March	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,332	664	966
September	6,151	6,939	274,608	3,511	150,916	1,514	128,061	1,086	56,702	672	999
October	6,135	6,834	269,442	3,457	149,661	1,545	139,128	1,066	56,541	642	1,065
November	6,346	6,975	264,566	3,530	150,604	1,622	133,886	1,120	54,891	636	1,104
December	6,394	7,238	258,385	3,605	155,400	1,668	108,144	1,187	52,105	729	1,301
1955:											
January	6,761	7,379	260,156	3,639	169,562	1,740	86,692	1,235	49,457	739	1,348
February	6,835	7,549	258,630	3,655	181,643	1,847	68,513	1,239	46,042	751	1,379
March	6,840	7,389	266,488	3,466	185,121	1,727	61,965	1,181	44,836	762	1,269
April	6,822	7,097	274,976	3,411	175,400	1,533	68,052	1,144	43,804	695	1,087
Apr., 1955: Change:											
In Month	−18	−292	+8,488	−55	−9,721	−194	+6,087	−37	−1,032	−67	−182
In Year	+207	+286	−5,334	+7	−1,606	+159	+244	+4	−558	+121	+137
Week Ended:											
5-13-55	6,682	7,061	278,208	3,448	171,134	1,434	72,710	1,067	44,161	622	917
5-14-54	6,428	7,020	273,924	3,436	175,750	1,279	65,531	1,162	44,996	551	830

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Market Outlook Greatly Improved

LESS GASOLINE NOW is in storage in the United States than a year ago. This constitutes a great improvement in the economic position of the U. S. oil industry. For the first time in several years the industry should not be troubled with excess supplies of gasoline during summer months. Consequently, markets this summer are expected to be firm and stable, whereas they have tended to be soft and somewhat unstable during recent years.

This is the present outlook, although crude stocks have been increasing lately and inventories of distillate fuel oil are higher than a year ago. However, these stocks are not expected to become too burdensome. The growth in crude stocks should be checked during the next couple of months. Crude production is to be cut in June and again in July. With gasoline consumption due to shortly begin climbing to its summer seasonal peak, refiners will be able to increase runs to stills and, therefore, will use more crude. At the same time, higher gasoline consumption will encourage refiners to adjust yields so they will make more gasoline and less distillate. This will keep distillate stocks from getting out of hand.

•

THE IMPROVED GASOLINE OUTLOOK is in direct contrast with indications a few months ago, and shows that the industry can adjust its operations sufficiently to keep supply in balance with fiuctuating seasonal demand when it really wants to do so.

During the early months of 1955 it apeared the industry again was to have excessive motor fuel inventories. At the end of March there were 4 million more barrels of gasoline in storage tanks than on the corresponding date of the previous year. Since that time, refiners have done a remarkable job of regulating refinery runs, and of adjusting the output of gasoline downward.

Crude runs to refinery stills averaged only a little over 7 million barrels daily between April 1 and May 13, just slightly greater than in 1954, and ⅓ million barrels less than in the first three months of the year. Since April 1 the output of gasoline has been down to approximately the same level as in 1954. Meanwhile, consumption has been higher than in 1954. Consequently, inventories of motor fuel today are 1½ million barrels less than a year ago, despite having been 4 million barrels above 1954 levels at the start of April.

Unless refiners throw caution to the winds and boost crude runs too rapidly during the next couple of months, the industry should not be troubled with excessive motor fuel inventories this summer. This will be a very important improvement over conditions which have existed during recent years.

•

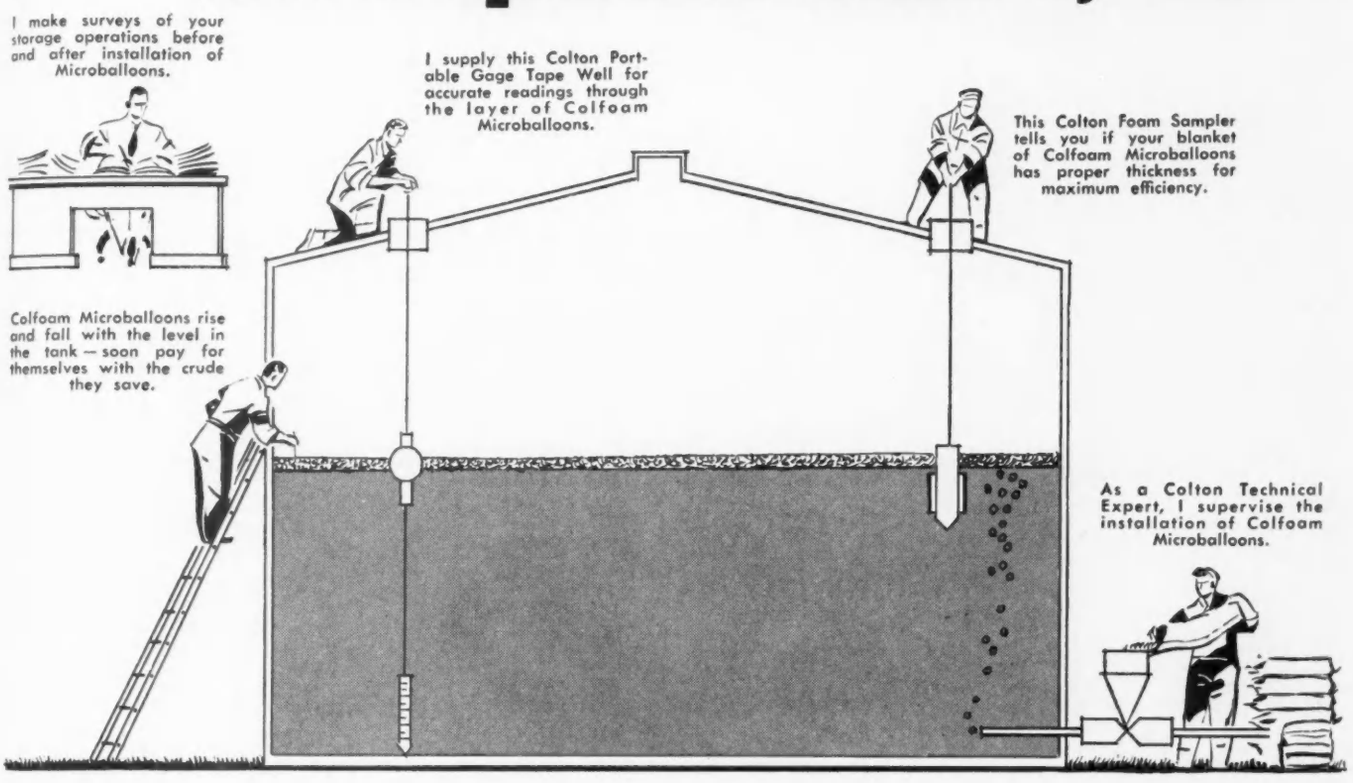
A BRIGHTER CRUDE OIL OUTLOOK also is in the making, due to scheduled reductions in producing rates during June and July. If imports of crude and refined products are curtailed sufficiently, supplies will be brought into line with demand and the recent rapid growth of crude stocks can be checked before becoming too burdensome.

Too much crude oil has been produced and imported since March 1. U. S. crude production in March and April averaged 6,830,000 barrels daily in contrast with 6,560,000 barrels in 1954. Meanwhile, crude imports averaged 730,000 barrels daily in March and April of this year, up 116,000 barrels from 1954 rates. Consequently, crude stocks increased by 18 million barrels between the first of March and May 14, and were approaching a near excessive volume.

Therefore, the outlook is brightened by prospective curtailment of producing rates in June and July. After cutting its May allowable by 214,000 barrels daily, Texas has reduced its June permissible output by another 65,000 barrels and will follow this with an additional 132,000 barrel per day reduction in July. Thus, Texas' July allowable will be more than 400,000 barrels under its March volume.

Now it is up to importers and other U. S. states to cooperate with Texas in its efforts to hold crude supplies down to requirements. If this is done, everything will be fine.

Colfoam Microballoon* blanket cuts evaporation losses by 86%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U. S. WELLS COMPLETED IN APRIL AND FIRST FOUR MONTHS, 1955 - 1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED — DETAILS FOR APRIL: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	TOTAL NEW WELLS: April 1955	Mar. 1955	April 1954	Total Footage April 1955	DETAILS FOR JANUARY-APRIL: NEW WELLS: 1955	1954	Percent Diff.	FOOTAGE: 1955	1954	Rigs in Operation: April 30, 1955	Mar. 31, 1955	April 30, 1954
Alabama				7				7	6	7	37,407	27	26	+ 3.8	115,776	133,721	3	7	5
Arizona										1		4	2	+100.0	16,136	10,120			1
Arkansas	36			31				67	52	38	208,532	202	184	+ 9.8	675,396	632,425	38	47	30
California	186		5	49				240	209	209	1,127,393	788	886	— 11.1	3,787,546	4,060,997	251	282	223
Colorado	34		6	90				130	106	118	699,801	452	399	+ 13.3	2,437,387	2,233,420	85	88	92
Florida									3	1		12	11	+ 9.1	74,689	77,973	5	3	1
Georgia													3	—100.0		11,068			3
Idaho				1				1			2,775	2			7,305			1	
Illinois	173		1	131	1			306	234	240	745,644	1,083	907	+ 19.4	2,624,456	2,243,985	268	242	231
Indiana	12			25			1	38	47	64	57,293	165	265	— 37.7	256,581	398,486	98	81	123
Kansas	205		36	177			1	419	381	306	1,542,393	1,465	1,287	+ 13.8	5,374,776	4,469,211	518	489	432
Kentucky	46		16	61	2			125	94	107	214,082	451	435	+ 3.7	758,822	838,222	101	96	93
Louisiana	207	21	13	91				332	318	225	2,226,081	1,294	1,049	+ 23.4	8,075,136	6,607,594	375	358	281
North Louisiana	115	5	3	26				149	162	124	445,292	667	548	+ 21.7	1,881,174	1,595,409	87	76	54
South Louisiana	92	16	10	65				183	156	101	1,780,789	627	501	+ 25.1	6,193,962	5,012,185	288	282	227
*Gulf of Mexico	17		1	10				28	21	16	263,218	95	50	+ 90.0	893,689	458,885	50	42	23
Maryland																	2	4	
Michigan	13			19				32	33	27	96,698	162	184	— 12.0	484,026	474,312	69	76	76
Mississippi	16	3		22				41	44	33	321,040	162	118	+ 37.3	1,241,267	801,538	40	46	31
Missouri	1			3				4	5	1	1,884	17	5	+240.0	9,719	6,333	3	1	
Montana	6			9				15	12	16	76,751	87	125	— 30.4	449,131	500,158	30	35	25
Nebraska	25		2	25				52	51	30	306,351	199	122	+ 63.1	1,140,226	675,640	38	34	24
Nevada									1	2		4	2	+100.0	29,916	12,910	1	2	5
New Mexico	81		35	25				141	139	67	577,803	473	367	+ 28.9	2,042,478	2,031,125	143	145	134
New York	18				11			29	27	54	40,011	107	233	— 54.1	147,931	324,287	47	45	85
North Dakota	15			6				21	22	24	164,481	72	82	— 12.2	537,701	583,065	22	24	27
Ohio	40		23	30				93	84	86	196,221	336	318	+ 5.7	721,643	620,575	203	204	193
Oklahoma	414	2	23	189	3		4	635	666	613	2,073,387	2,272	2,846	— 20.2	7,742,088	9,423,827	654	660	754
Oregon																	1	1	
Pennsylvania	19		20	7	16	5		67	55	91	131,933	238	390	— 39.0	447,948	671,860	109	106	223
South Dakota				2				2			17,286	4	10	— 60.0	24,038	43,960	1	2	3
Texas	863	33	41	503	7			1,447	1,583	1,546	6,233,921	6,186	5,869	+ 5.4	27,040,595	26,873,274	1,336	1,346	1,354
Dist. 1: South Central	85	1		51				137	166	86	368,659	569	326	+ 74.5	1,535,494	1,141,717	59	54	36
Dist. 2: Middle Gulf	20	4	6	35				65	65	58	369,455	260	293	— 11.3	1,570,163	1,754,682	42	29	41
Dist. 3: Upper Gulf	63	7	2	55				127	170	118	798,040	573	535	+ 7.1	3,681,814	3,693,791	132	129	114
*Gulf of Mexico	1			4				5	1		48,723	6			62,109		3	4	
Dist. 4: Lower Gulf-S.W.	45	7	2	54				108	117	151	511,764	452	510	— 11.4	2,342,376	2,635,835	69	67	99
*Gulf of Mexico									3			6			54,743		3		1
Dist. 5: East Central	5		1	11				17	30	24	57,135	98	79	+ 24.1	401,659	290,619	12	17	14
Dist. 6: Northeast	14	10	4	17				45	51	53	252,961	196	224	— 12.5	1,095,069	1,390,335	53	55	56
Dist. 7-B: North Central	130		3	127	1			261	265	244	758,081	1,043	940	+ 11.0	3,088,938	3,102,261	150	157	145
Dist. 7-C: West Central	61		5	25				91	116	113	483,197	414	431	— 4.0	2,246,129	2,185,448	130	139	141
Dist. 8: West	228	1	1	50	6			286	339	272	1,532,292	1,173	903	+ 29.9	6,395,422	5,430,903	383	386	355
Dist. 9: North	160		1	69				230	176	323	823,092	1,072	1,285	— 16.6	3,524,830	4,129,171	240	242	256
Dist. 10: Panhandle	52	3	16	9				80	88	104	279,245	336	343	— 2.1	1,158,701	1,119,112	66	71	97
Utah	2			10				12	3	5	47,831	35	17	+105.9	177,621	99,513	16	13	15
West Virginia	9		21	12				42	48	40	97,982	194	158	+ 22.8	507,873	443,312	184	175	154
Wyoming	35			12				47	44	91	220,551	226	456	— 50.4	1,148,578	2,353,733	72	70	85
Total United States	2,456	59	242	1,537	40	5	6	4,345	4,267	4,042	17,465,532	16,719	16,756	— 0.2	68,096,785	67,656,644	4,713	4,683	4,709
Total Western Canada	91		6	36			2	135	197	162	558,245	774	659	+ 17.5	3,377,880	2,723,575	100	186	150

*Gulf of Mexico wells are included in their respective district totals.

April Wells at New Peak

107 offshore wells drilled in first four months.

U. S. DRILLING is on the increase, and after four months of playing catch-up to last year's record-breaking operations, the current program is within easy passing distance. Wells completed during April reached a new high for the year, and almost closed the gap between the two-years' operations. By the end of the month, only 37 wells separated this year's activities from the 1954 record.

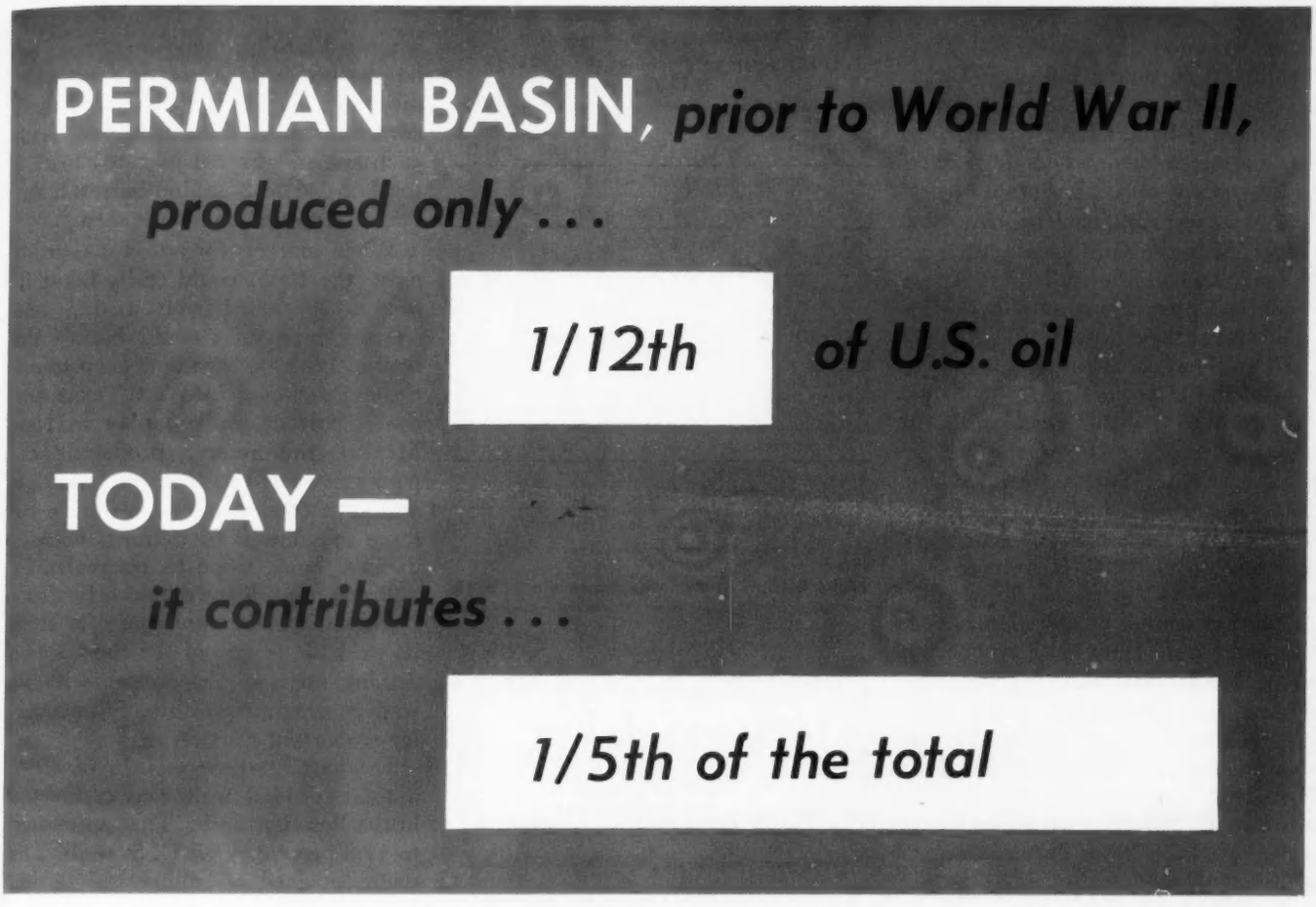
April's completions totaled 4345, a new monthly high for the year. The month earlier had seen 4267 wells completed, and the total recorded in April, 1954 had been only 4042. April's wells brought the year's total to 16,719, which was only 37 wells, or 0.2 percent, behind the 16,756 recorded in the first four months of last year.

For the first time, WORLD OIL is statistically separating the wells drilled on the Continental Shelf in the Gulf of Mexico. These details will continue to be part of the monthly summary of U. S. and Western Canada's drilling activity.

This year has been a banner period in offshore drilling history, with activity at a peak and continuing to expand. In four months of 1955, a total of 107 wells was completed off the shores of Louisiana and Texas. Louisiana was the locale for the largest part of this operation, as 95 of the wells fell within the extensions of the state's bounds. A year earlier, only 50 wells had been drilled in the same period. All belonged to Louisiana.

As April closed, 56 drilling rigs were actively engaged in this offshore work, 50 in Louisiana and the remaining six in Texas waters. Forty-five rigs were drilling a month earlier, and a year ago the count had been only 24.

The picture in Western Canada at present is not quite so bright as in the U. S. However, the slackening that occurred during April is believed to be only temporary and caused principally by the spring thaws and bad weather conditions.



. . . and the Basin Is Still Booming

Development of three major trends is adding stature to this already vast oil reserve.

By CECIL W. SMITH, WORLD OIL Staff

THE VAST and prolific Permian Basin has risen from an uninviting "wildcatters' graveyard" to one of the most important and promising oil regions of the world. This great geologic bowl underlying about 75,000 square miles of West Texas and southeastern New Mexico began hitting its stride shortly after World War II and now contributes more than one-fifth of the nation's oil.

The Basin today produces one-fourth again as much as Russia, and is out-produced by only one nation other than the U. S.—Venezuela. The entire European crude output amounts to only slightly more than the take from the Permian Basin.

The greater part of this basin lies in Texas and extends into southeastern New Mexico, with the Texas portion closely approximating Railroad Commission Districts 7-C and 8. Between 80 and 85 percent of the crude produced comes from the Texas side.

Current drilling activity is at a high level in the Basin. Three important trends are being developed, and each promises to be major in scope and to add considerably to the reserves of the region. These are: Virey-Ellenburger and Jameson-Strawn Trends of West Texas, and the Drickey-Caprock Queen play of New Mexico. All are discussed on following pages.

Recoverable crude reserves in the Permian Basin have been estimated by some to be around 4 billion barrels, which would mean that the region contains more than one-fourth of the Texas total.

Attesting to this region's prominence in the nation's oil picture were recent data on U. S. crude production. At the end of April, Permian Basin was producing 1,394,650 barrels of crude and lease condensate a day, to account for 20.4 percent of the nation's daily of 6,833,450 barrels.

The Basin's performance is being outranked only by the Mid-Continent

and Gulf Coast regions. Both are older in oil production, and the Mid-Continent is much larger in area. Crude production in the Mid-Continent led the nation with 1,980,900 barrels a day, which amounted to 29 percent of U. S. output.

The second ranking oil province of the U. S. is the Gulf Coast, smallest in land area of the top three. There crude and lease condensate was being produced at the daily rate of 1,581,100 barrels. That constituted 23.1 percent of the U. S. total.

Outranked by the Permian Basin is California, fourth in the nation productionwise, and where output falls just short of 1 million barrels a day. California's crude currently amounts to 975,000 barrels a day, and that is 14.3 percent of the total.

Another section of the country that is coming to the front in oil production is the Rocky Mountain region. Production is gaining fairly rapidly; however, it still produces considerably less than one-half as much as the Permian Basin. Rocky Mountain output amounts to 533,750 barrels daily.

Basin production at the end of April included 1,383,700 barrels of crude and 10,950 barrels of lease condensate per day. That included 222,000 barrels of crude and 4000 barrels of condensate from New Mexico, and 1,161,000 barrels of crude and 6,950 condensate from the West Texas sector. Of the Texas portion, District 8 provided the lion's share with 966,700 barrels of crude and 2100 barrels of condensate, and District 7-C contributed a total of 199,850 barrels, 195,000 crude and 4850 condensate.

It was not until 1951 that daily production from the Permian Basin averaged 1 million barrels. It was also the same year that the 1-million mark was reached in the West Texas part.

Permian Basin Crude Production Compared With Other U. S. Regions
(Daily Average of end of April, 1955)

REGION	Barrels Daily	% of U.S.
Mid-Continent (Tex. Dists. 1, 5, 6, 7-B, 9, 10; N. La.-Ark.; Okla.-Kans.-Mo.; E. Neb.)	1,980,900	29.0
Gulf Coast (Tex. Dists. 2, 3, 4; S. La.; Miss.; Ala.; Fla.)	1,581,100	23.1
Permian Basin (Tex. Dists. 7-C, 8; S. E. New Mexico)	1,394,650	20.4
California	975,600	14.3
Rky. Mts. (Colo., Utah, N.W. New Mex.; W. Neb., Wyo., Mont., Nev., N. Dak., S. Dak.)	533,750	7.8
Middle West (Ill., Ind., Ky., W. & Cent. Ohio, Mich., Tenn.)	325,200	4.8
Appalachian (N. Y., Pa., Va., W. Va., E. Ohio)	42,250	0.6
Total U. S.	6,833,450	100.0

Wells Drilled in Permian Basin since 1946

YEAR	Wells	% of U.S.	Footage	% of U.S.
1946	2887	9.6	12,421,028	12.3
1947	2765	8.3	12,970,469	11.5
1948	3859	9.8	18,970,469	13.2
1949	3768	9.6	18,614,504	13.4
1950	5596	12.9	29,369,191	18.4
1951	5923	13.2	32,278,274	18.5
1952	5838	12.7	34,695,194	18.6
1953	4475	9.0	25,596,746	12.9
1954	4962	9.6	28,211,866	13.5
1955: 3 Months	1463	11.8	7,807,958	15.4

During the first four months of 1955, Permian Basin crude output was at an all-time high. It averaged 1,383,800 barrels daily, and had climbed to 1,394,650 by the end of the period. The peak full year was 1953, when daily production averaged 1,251,050 barrels. A slight drop to 1,222,050 daily occurred in 1954, with New Mexico continuing its steady increase, and the Texas side being cut back on its allowable flow.

This great oil province has produced a grand total of more than 5½ billion barrels since oil was first discovered in 1921, for a lifetime average of 454,650 barrels a day.

Relatively little of Permian's crude is refined locally; therefore, large pipe line systems are necessary to move the oil to market points. Capacity of these carriers is more than adequate. With each system carrying its rated load, a total of 1¾ to 2 million barrels a day could be moved out of the area.

When markets for additional crude exist, the Basin could easily boost its output 200,000 barrels a day, and existing pipe lines could handle the traffic. With the two new deep trends being developed in West Texas and the important shallow play in New Mexico, this reserve producing capacity is most probably conservative, and in a few years this available reserve might well be doubled without damage being done to reservoirs.

Production in the region is far from being settled and apparently far from its peak. It is one of the most active drilling areas of the nation, with its wildcat program consistently uncovering important discoveries.

In the first three months of 1955, a total of 1463 wells was completed in the Permian Basin. That amounted to 11.8 percent of all U. S. wells. The region reached its drilling peak during 1951, when wells numbered 5923. However, that level might be surpassed this year.

Because of the importance of the deeper zones, Permian Basin wells, on the average, are deeper than they are in many other U. S. areas. Footage drilled totaled 7,807,958 in the first three months this year, and that amounted to 15.4 percent of the U. S. total. The greatest amount of annual footage was drilled in 1951, when 18.5 percent of the nation's was recorded. This year's wells have been drilled to an average depth of 5337 feet, while the national average has been only 4092 feet. —**The End**

Crude Oil Production in Permian Basin, by Districts and Years

Sources: Texas, 1921-1938, private sources; 1939-January, 1955, Texas Railroad Commission; February-April, 1955, A.P.I. . . . New Mexico, 1924-1946, private sources; 1947-1948, New Mexico Oil Conservation Commission; 1949-February, 1955, U. S. Bureau of Mines; March-April, 1955, A.P.I.

(Data in Barrels)

	TEXAS DISTRICT 7C		TEXAS DISTRICT 8		TOTAL WEST TEXAS		S.E. NEW MEXICO		TOTAL PERM. BASIN	
YEAR	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily
1922-1945	192,893,667	22,000	1,520,374,500	173,450	1,713,268,167	195,450	451,490,343	51,500	2,164,758,510	246,950
1946	10,075,235	27,600	180,813,239	495,400	190,888,474	523,000	35,282,263	96,650	226,170,737	619,650
1947	13,906,004	38,100	206,514,967	565,800	220,420,971	603,900	40,521,243	111,000	260,942,214	714,900
1948	16,668,257	45,550	259,453,586	708,900	276,121,843	754,450	47,235,804	129,050	323,357,647	883,500
1949	16,807,896	46,050	210,767,351	577,450	227,575,247	623,500	47,310,000	129,600	274,885,247	753,100
1950	20,917,096	57,300	262,985,846	720,500	283,902,942	777,800	47,036,000	128,850	330,938,942	906,650
1951	35,988,102	98,600	341,617,737	935,900	377,605,839	1,034,500	52,392,000	143,550	429,997,839	1,178,050
1952	54,182,303	148,050	341,853,271	934,000	396,035,574	1,082,050	58,778,000	160,600	454,813,574	1,242,650
1953	59,501,130	163,000	327,499,912	897,250	387,001,042	1,060,250	69,639,000	190,800	456,640,042	1,251,050
1954	63,713,643	174,550	307,924,373	843,650	371,638,016	1,018,200	74,408,000	203,850	446,046,016	1,222,050
Total Thru 1954	484,653,333	40,200	3,959,804,782	328,550	4,444,458,115	368,750	924,092,653	76,650	5,368,550,768	445,400
1955: 1st 4 Months	23,187,250	193,250	116,279,950	969,000	139,467,200	1,162,250	26,585,750	221,550	166,052,950	1,383,800
Total Thru Apr. 1955	507,840,583	41,700	4,076,084,732	334,850	4,583,925,315	376,550	950,678,403	78,100	5,534,603,718	454,650

Drilling is deep, hard and long in the Virey-Ellenburger trend as evidenced by this powerful rig (right) drilling "the 19th hole" on the Odessa (Texas) Country Club golf course in Ector County.

A WEST TEXAS-NEW MEXICO FEATURE

Potential as high as 3200 barrels of 49-gravity crude daily from below 13,000 feet keep the West Texas spotlight on . . .

The Virey-Ellenburger Trend

By JAMES R. (DICK) SIMMONS, Warren Petroleum Corporation, Midland, Texas

With the discovery and completion in December, 1953, of Reynolds Mining Corporation's Roy Parks 1, from the Bend limestone of Pennsylvanian age, a splurge of drilling activities sprang up extending north and south along a narrow strip of land bordering eastern Ector and western Midland counties in West Texas.

The new field discovery, later known as the Virey Pennsylvanian and Ellenburger field has now developed into a major trend referred to here as the Virey Trend. Roy Parks 1, completed for a flowing potential of 407 barrels of 43.5 degrees API gravity oil, from a depth of 10,170 to 10,188 feet, helped prove the theorized concept of a structural trend in the area that may join the Pagasus field to the south with the recently discovered Headlee field to the north. By May, 1954, Ellenburger production was assured, with completion of Warren Petroleum Corporation's Wallin 1 for 671 barrels of oil from 13,270 to 13,400 feet.

In August, 1953, Forest Oil Corporation and Cities Production Corporation leased the Roberts Ranch to the west of the new discovery with this possible trend in mind. The Roberts Ranch comprising some 19,-

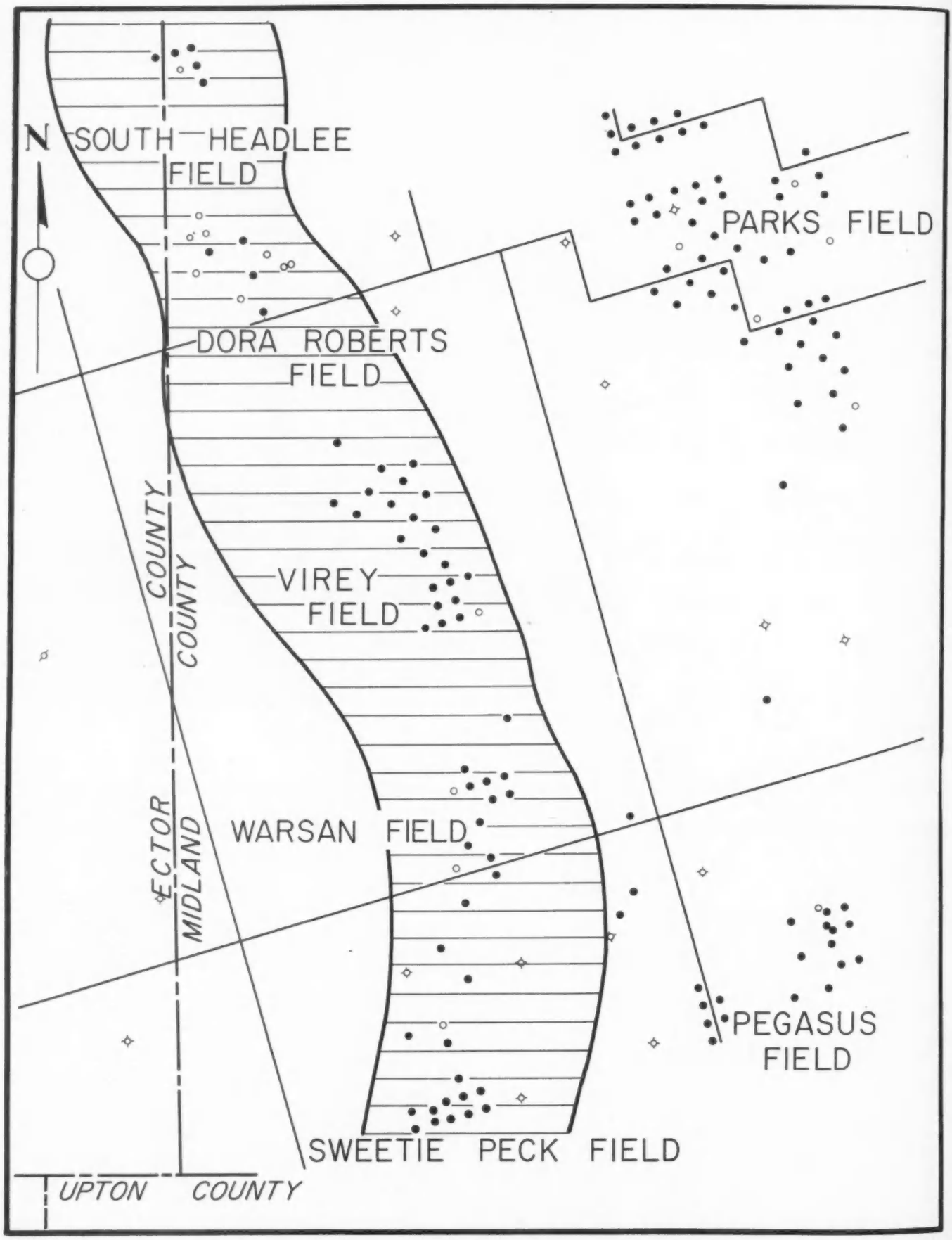


FIGURE 1—General outline of the Virey-Ellenburger trend is shown in the cross-hatched area. The trend extends about 16 miles from north to south and about four miles from east to west. Producing wells between known fields support the idea of a continuous reservoir.

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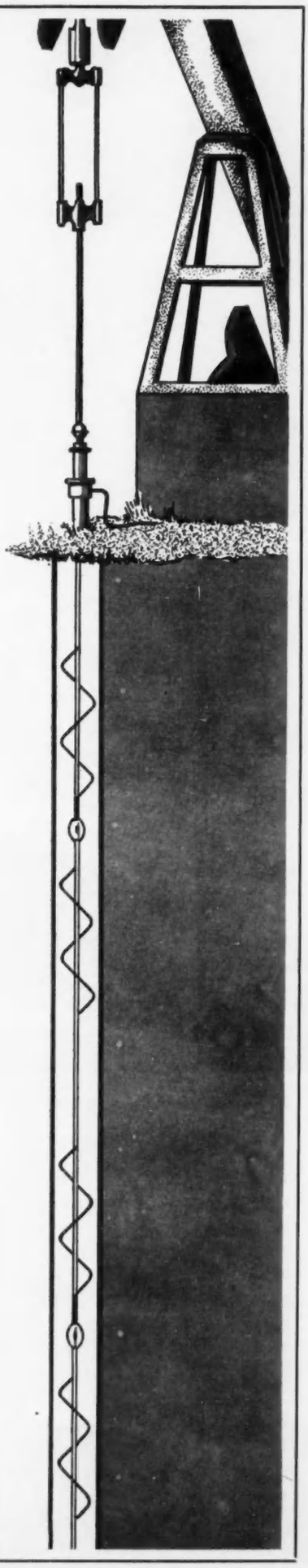

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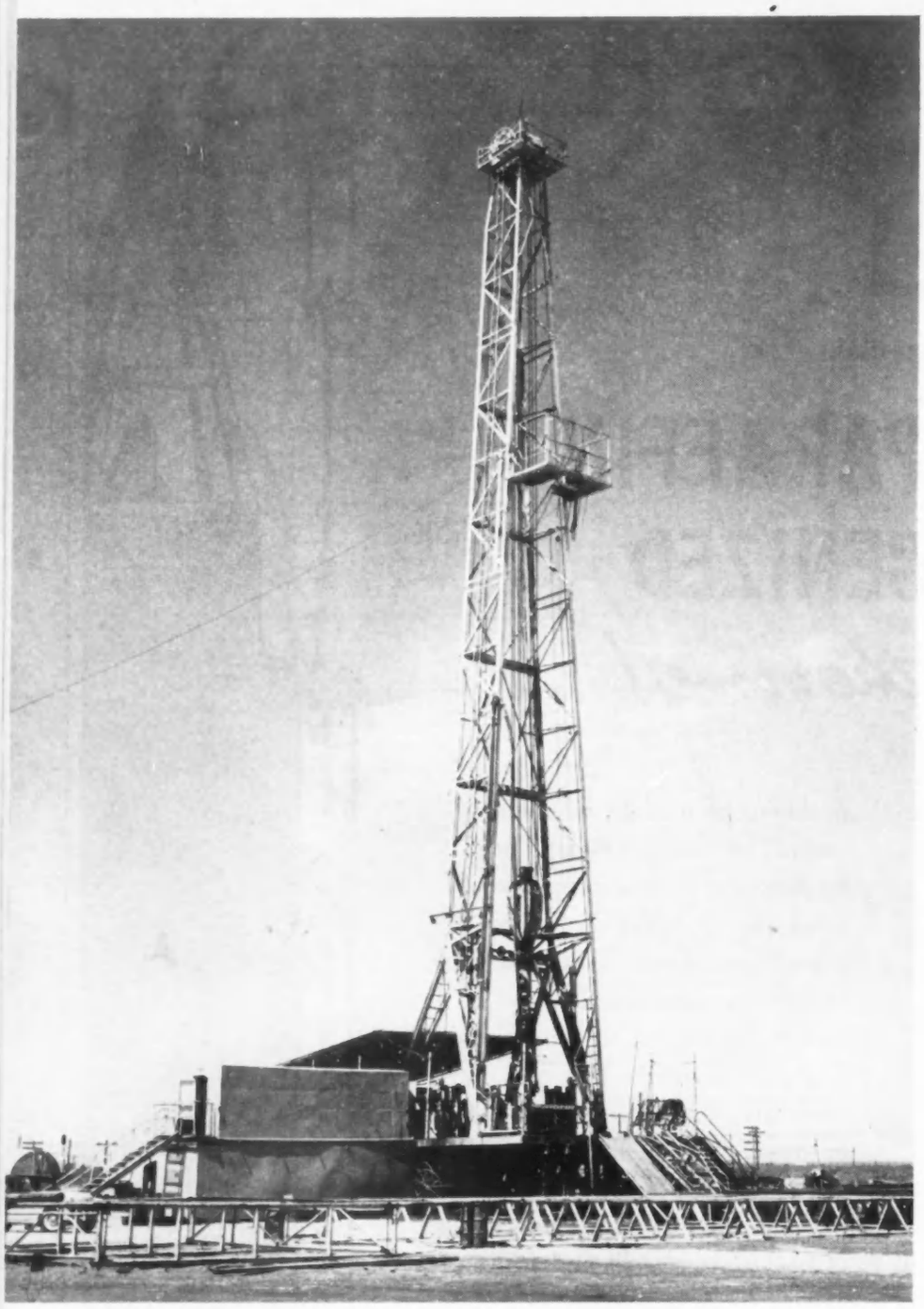

In spite of the deep, hard drilling, some wells in the Virey-Ellenburger trend are being drilled with power rigs of this type.

000 acres, had not been explored either by geophysical surveys or by drilling wells and lay in virgin territory in respect to oil and gas production. It was not until the acquisition of this acreage by Forest Oil Corporation and Cities Production Corporation for a reported sum of over $5 million that the trend play was born.

Intense geophysical exploration work soon began after the procurement of the ranch property. After several months of research on the interpretation of geophysical data, the first location was staked on the ranch. The location of the Forest Oil and Cities Production Corporation Dora Roberts "C-4" No. 1, was 1980 feet north and east, of Section 46, Block 41, T-3-S, in what is now known as the Warsan field. However, the "C-4" No. 1 was not the first well drilled in the Warsan field. To the north-east approximately 3700 feet, in section 38, Warren Petroleum Corporation drilled June Sanders 1 to 13,394 feet into the Ellenburger formation.

Though the well had penetrated the Ellenburger and had tested oil and gas in this formation, the Ellenburger hole was subsequently lost thru mechanical failure. The well was then plugged back to 11,317 feet in the Pennsylvanian (Bend) formation and completed from this zone for a flowing potential of 1176 barrels of 41 degrees API gravity oil per day through perforation at 10,450 to 10,470, thereby establishing a new discovery and new field. The Dora Roberts "C-4" No. 1 was drilled shortly thereafter and completed as a new discovery in the Ellenburger formation from a total depth of 13,233 feet and for a potential flow of 3204 barrels and 49 degrees gravity oil per day.

At the present time there are ten completions in the field, of which 5 are Ellenburger producers, 4 Pennsylvanian, and 1 Fusselman producer.

With the completion of the first exploratory well on the ranch, Forest Oil and Cities Production Corporation moved in five drilling rigs and began an intense search and development of the ranch acreage. With the already discovered Virey field to the north, three of the rigs were placed in operation in this area, one remaining in the Warsan field and the other rig was moved into the extreme north end of the ranch on a new wildcat location. This new wildcat well was to be called the Dora Roberts "B-1" No. 1, located 1980 feet from the north and east of Section 42, Block 41, T-2-S. Again the accumulated geophysical data were invaluable, for the well was completed from the Ellenburger formation at a total depth of 13,012 feet, and for a potential flow of 2163 barrels of 52.2 degree gravity oil per day.

This new discovery opened up the north end of the ranch and established a new field known as the Dora Roberts Ellenburger field. There are seven completions in the Dora Roberts field at present. Six are Ellenburger producers, and one is a dual completion from the Pennsylvanian and Ellenburger formations.

While drilling activities were under way to the north and south, the Virey field also felt this sudden splurge of activity. With Forest Oil and Cities Production Corporations drilling three new exploratory wells in the field, Warren Petroleum, Cities Service, and Magnolia Petroleum Company were engaged in the further development of this field. To understand something

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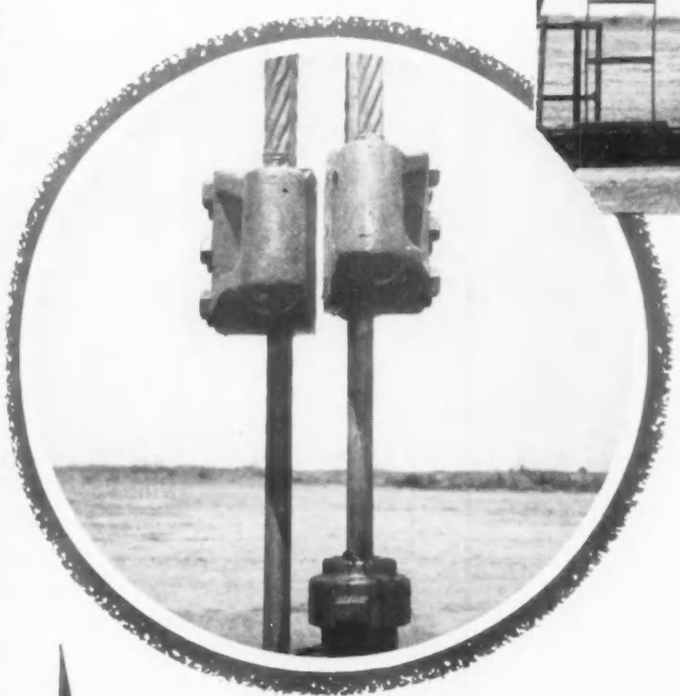

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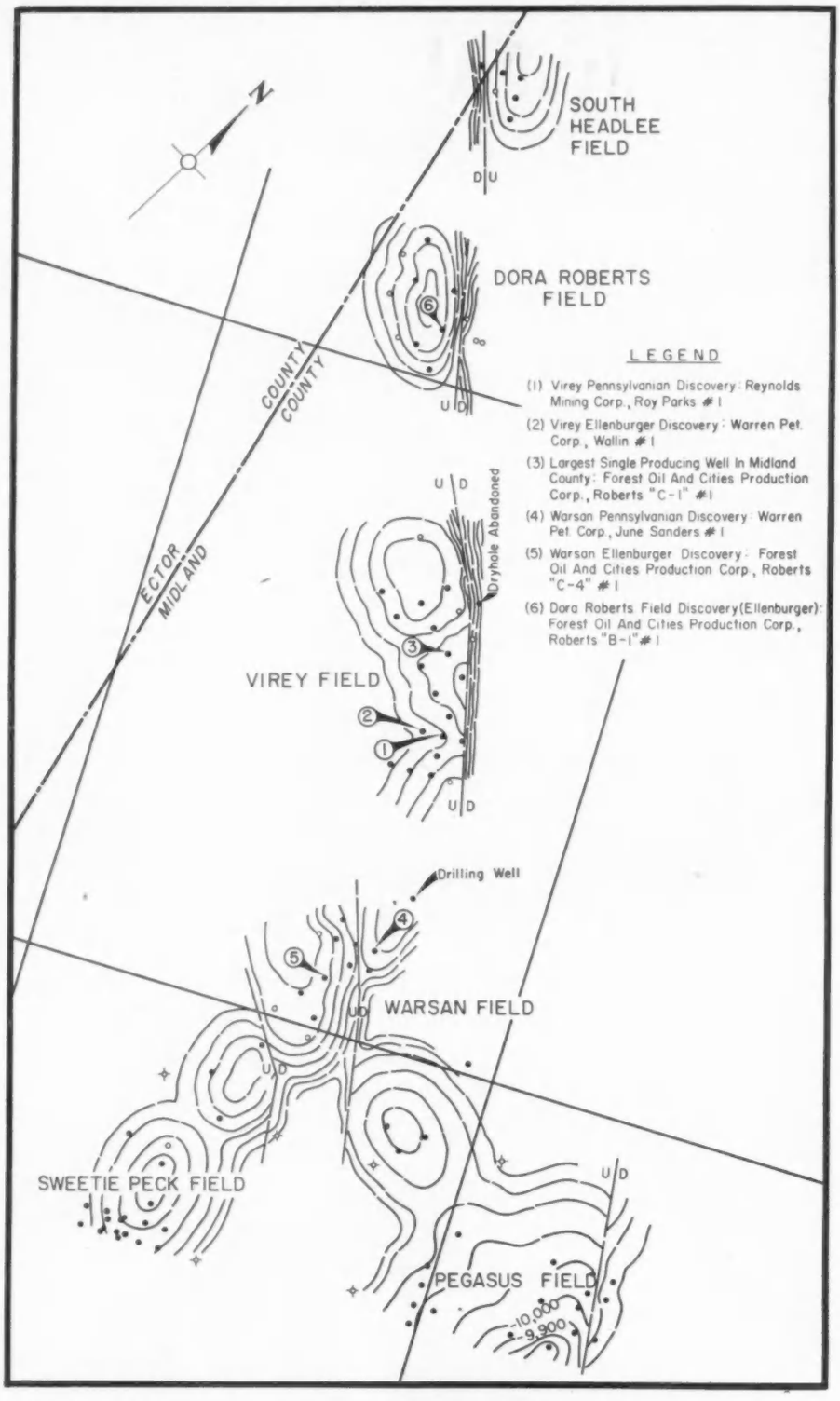
N
SOUTH HEADLEE FIELD
DORA ROBERTS FIELD
LEGEND
(1) Virey Pennsylvanian Discovery: Reynolds Mining Corp., Roy Parks #1
(2) Virey Ellenburger Discovery: Warren Pet. Corp., Wallin #1
(3) Largest Single Producing Well In Midland County: Forest Oil And Cities Production Corp., Roberts "C-1" #1
(4) Warsan Pennsylvanian Discovery: Warren Pet. Corp., June Sanders #1
(5) Warsan Ellenburger Discovery: Forest Oil And Cities Production Corp., Roberts "C-4" #1
(6) Dora Roberts Field Discovery(Ellenburger): Forest Oil And Cities Production Corp., Roberts "B-1" #1
COUNTY
COUNTY
ECTOR
MIDLAND
Dryhole Abandoned
VIREY FIELD
Drilling Well
WARSAN FIELD
SWEETIE PECK FIELD
PEGASUS FIELD
-10,000
-9,900

FIGURE 2—Partial contour map on top of the Ellenburger through the Virey-Ellenburger trend. Contour interval is 100 feet. Legend indicates significant wells drilled in the trend.

of this new trend and its development a study should be made into the heart of the trend, mainly the Virey Field, for here the general character of its stratigraphy, completions methods, and drilling aspects may be found that are essentially applicable to other expanding fields in the trend.

Virey field. Structurally, the Virey field is relative to the established structures found paralleling the Central Basin Platform mainly in Ector, Midland and Upton counties. At this writing, there appears to be a general alignment of the structural axis trending in a north-west direction to the Dora Roberts and Headlee fields and in a southwest direction toward the Warsan and Sweetie Peck fields. The structural axis may be noted (Figure 2) to deflect from a true northwest, southeast direction after entering the Virey field. Such a deflection is parallel to the deflection found in the Parks field to the east and its trend with the Pegasus field to the south.

The Virey structure is unique in its complexity, in that it not only bears the appearance of an elongated assymetrical folded type structure, but also is characterized by a fault lying on the east flank paralleling the structure. The trend of this fault appears to be in a northwest and southeast direction, with its upthrown block to the west and downthrown block to the east. This fault anomaly is more pronounced on the structural contours drawn on the Ellenburger formation than any other horizon. Contours drawn on other horizons indicate a more flattening of the structure than is seen on the contours of the Ellenburger.

Indication of this fault or faults was first noticed in the wells that showed repetition of formations, these wells being the Cities Service Roy Parks No. 1, Section 14, and Cities Service TXL "L" 1 and 2 in Section 23. In the above wells the Parks No. 1, had repetition of lower Simpson section while the TXL "L" wells had repetition of the Silurian and Fusselman sections. After completion of these wells, the Magnolia Reynolds Parks No. 4, Section 26, and Forest and Cities Production Roberts "B-3" No. 2, in Section 15 were drilled and both of the wells also encountered repeated sections.

The Roberts "B-3" No. 2, repeating the lower Montoya section, and the Reynolds Parks repeating the upper Simpson section. With the completion of these wells and probable establishment of this fault zone, the complexity of the structure took on a different picture by the drilling of the Phillips Roy Parks No. 1-A, in Section 14. This well was plugged and abandoned at a total depth of 13,851 feet after it was found to be 775 feet low structurally to the Cities Service Roy Parks No. 1, 2400 feet to the south, on the top of the Ellenburger.

Not only did the Phillips wells further identify this fault zone on the

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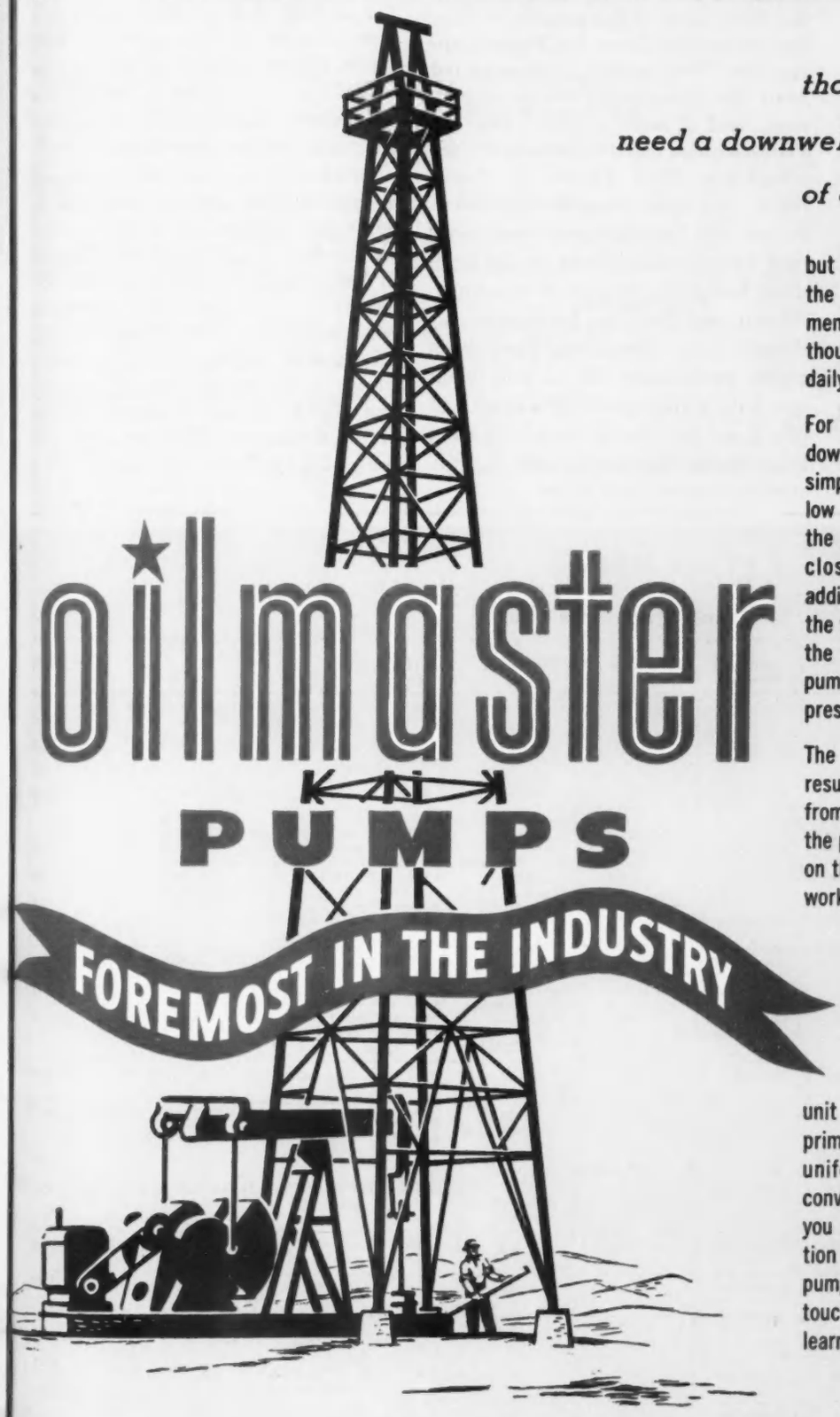

that an oil well might

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The combination achieved some interesting results. With the top of the plunger protected from the high pressure fluid in the tubing, the pump couldn't pound fluid. The fluid load on the hollow polished rod did the necessary work of compressing the gas and transferring the fluid from the pump barrel to the annular chamber on the downstroke, and in addition it kept the rods in tension.

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east flank, but it probably has proved the east extension of the field. All the wells that encountered repeated sections were completed from the Ellenburger as producers with one exception, that being the Cities Service Roy Parks No. 1.

The Cities Service Roy Parks No. 1, although originally completed from the Ellenburger formation for a flowing potential of 3324 barrels of oil per day, later started making formation water. This well was reworked eight months later and drilled 50 feet deeper to assure the water produced was formational and after satisfactory tests, the well was plugged back to the Fusselman formation for recompletion. The Fusselman formation was completed for a flowing potential of 1159 barrels of 46.8 degree gravity oil per day, from perforations at 12,260-280 feet, and at this time is the only well in the Virey field producing from this formation.

The main producing formation in the field is the Ellenburger dolomite. A total of 18 wells has been drilled in the Virey field at the present, 4 have been completed from the Pennsylvanian lime (Bend series), 1 recompleted from the Ellenburger to the Fusselman, and 2 wells dualed from the Pennsylvanian and Ellenburger, (see completion chart Figure 4). Additional pay zones besides the Ellenburger and Pennsylvanian formations may have possibilities in the field, these being the lower Wolfcamp, Strawn, and Devonian formations. Although these formations have been tested periodically by various wells and have shown good signs of oil and gas, none have been completed from these formations at this time.

Drilling and completion practices. Drilling conditions in the Virey Ellenburger field follow very closely to the established operational procedures of the Pegasus and Sweetie Peck fields. The average well is drilled in 85 days from under surface pipe to total depth. Fifteen additional days are required for the running of various casing strings, waiting on cement, and other completion procedures.

Crooked hole effects are minimized by proper selection of bits, drilling fluids and amount of weight carried on the bits. Usual practice in regard to weight and the amount of drill collars used varies with the operators. Some find the use of 2 8-inch and 20 6-inch drill collars, with a rotary speed of 80 revolutions per minute, and 50,000 pounds of weight on the bit in drilling to 9200 feet, and the use of 25 5¼-inch drill collars, and a

TABLE 1

Completion Data Chart

Operator and Well Name	Location and Elevation	Production Formation	Total Depth, Feet	Top of Pay, Feet	Amount of Pay, Feet	Potential
Forest and Cities Prod. Corp. Fee "15" No. 1	660 S. & 1980 E., Sec. 15, Elev. 2879	Ellenburger	13,292	13,055	231	F. 3203 bbls. 1" chk., GOR. 1275/1, Gr. 52.2, Acid 5,000 gals.
Fee "22" No. 1	660 E. & 1980 S., Sec. 22, Elev. 2909	Ellenburger	13,322	13,104	217	F. 2319 bbls. 1" chk., GOR. 555/1, Gr. 52.1, Acid 16,000 gals.
Roberts "B-3" No. 1	1980 S. & W, Sec. 15, Elev. 2888	Ellenburger	13,084	12,957	144	F. 2832 bbls. 1" chk., GOR. 1082/1, Gr. 51.8, Acid 15,000 gals.
Roberts "B-3" No. 2	1980 N. & E., Sec. 15, Elev. 2860	Ellenburger	13,082	12,982	110	F. 2157 bbls. 1" chk., GOR. 1075/1, Gr. 52.1, Acid 5,000 gals.
Roberts "C-1" No. 1	660 N. & E., Sec. 22, Elev. 2903	Ellenburger	13,316	13,090	226	F. 3573 bbls. 1" chk., GOR. 1158/1, Gr. 51.9, Acid 1,000 gals.
Roberts "C-1" No. 2	1980 N. & E., Sec. 22, Elev. 2914	Ellenburger	13,247	13,112	135	F. 1211 bbls., 1" chk., GOR. 863/1, Gr. 58.1, Acid 5,000 gals.
Cities Service Corp. Parks No. 1	660 S. & W., Sec. 14, Elev. 2878	Ellenburger Fusselman	T.D. 13,083 New T.D. 13,133 PBD 12,985	Ellen. 13,018 Fuss. 12,260 Pert. 260-280	Ellen. 651 Fuss. 20	Ellen.-F. 3324 bbls. 1" chk., GOR. 1075/1, Gr. 57.2, Acid 1,000 gals. Fuss.-1159 bbls., ¾" chk., Gr. 48.8, GOR. 1235/1
TXL "L" No. 1	660 S. & W., Sec. 23, Elev. 2904	Dual Ellen. & Penn. (Bend)	13,193	Ellen. 13,128 Penn. 10,333 Perfs. 10,333-58	Ellen. 65 Penn. 25	Ellen.-F. 2095 bbls. ¾" chk., GOR. 1150/1, Gr. 52.1. Penn.-F. 1720 bbls. 23/64" chk., GOR. 4870/1, Gr. 52.7
TXL "L" No. 2	1980 N. & 660 W., Sec. 23, Elev. 2894	Ellenburger	13,036	12,975	61	F. 3041 bbls. 1" chk., GOR. 1153/1, Gr. 53, Acid 5,000 gals.
Magnolia Pet. Corp. Reynolds Mining Parks No. 1 (Formerly Reynolds Mining Co., Roy Parks No. 1)	660 N. & W., Sec. 26, Elev. 2914	Penn (Bend)	10,531	10,170 Perfs. 10,170-188	8	F. 408 bbls. ¼" chk., GOR. 1282/1, Gr. 43.5, Acid 5,000 gals.
Reynolds Parks No. 2	1980 S. & 660 W., Sec. 26, Elev. 2908	Penn (Bend)	10,529 PB 10,337	10,233 Perfs. 10,233-54 10-270-360	10	F. 292 bbls. 15/64" chk., GOR. 1238/1, Gr. 41.6, Acid 5,000 gals.
Reynolds Parks No. 3	1980 N. & 660 W., Sec. 26, Elev. 2911	Ellenburger	13,266	13,192	65	F. 437 bbls. 11/64" chk., GOR. 805/1, Gr. 52.0, Acid 6,000 gals.
Reynolds Parks No. 4	1980 W. & 660 N., Sec. 26, Elev. 2920	Ellenburger	13,255	13,187	68	F. 427.95 bbls. 22/64" chk., Gr. 52.2, GOR. 803/1, Acid 22,000 gals.
Warren Pet. Corp. Emma Gray No. 1	1980 S. & E., Sec. 27, Elev. 2897	Penn.	10,720	10,660	58	F. 1378.54 bbls. 24/64" chk., GOR. 830/1, Gr. 40, Acid.
Emma Gray No. 2	1980 S. & 660 E. Sec. 27, Elev. 2897	Ellenburger	13,311	13,200	111	F. 1237.60 bbls. 32/64" chk., GOR. 926/1, Gr. 52, Acid 12,000 gals.
Wallin No. 1	660 N. E. Sec. 27, Elev. 2904	Ellenburger Re-Completed Penn. & Ellen.	13,424 PB 10,470	Ellen. 13,276 Tp pay 9876 Penn. 10,380-400 10,415-30	93 39	Ellen.-F. 671 bbls. 45/64" chk., GOR. 1015/1, Gr. 52, Acid 4,000 gals. Penn.-F. 701 bbls. ¾" chk., GOR. 1322, Gr. 48, Acid—Natural
Wallins No. 2	1988.8 N. & 660 E. Sec. 27, Elev. 2898	Penn.	10,753	10,385 Perfs. 10,385-97 10,425-455	20	F. 1275.12 bbls. oil + 6 bbls. wtr., 45/64" chk., GOR. 1826/1, Gr. 43.4, Acid 5,000 gals.

Ellenburger Allowable 425 bbls./day. Pennsylvania Allowable 210 bbls./day.

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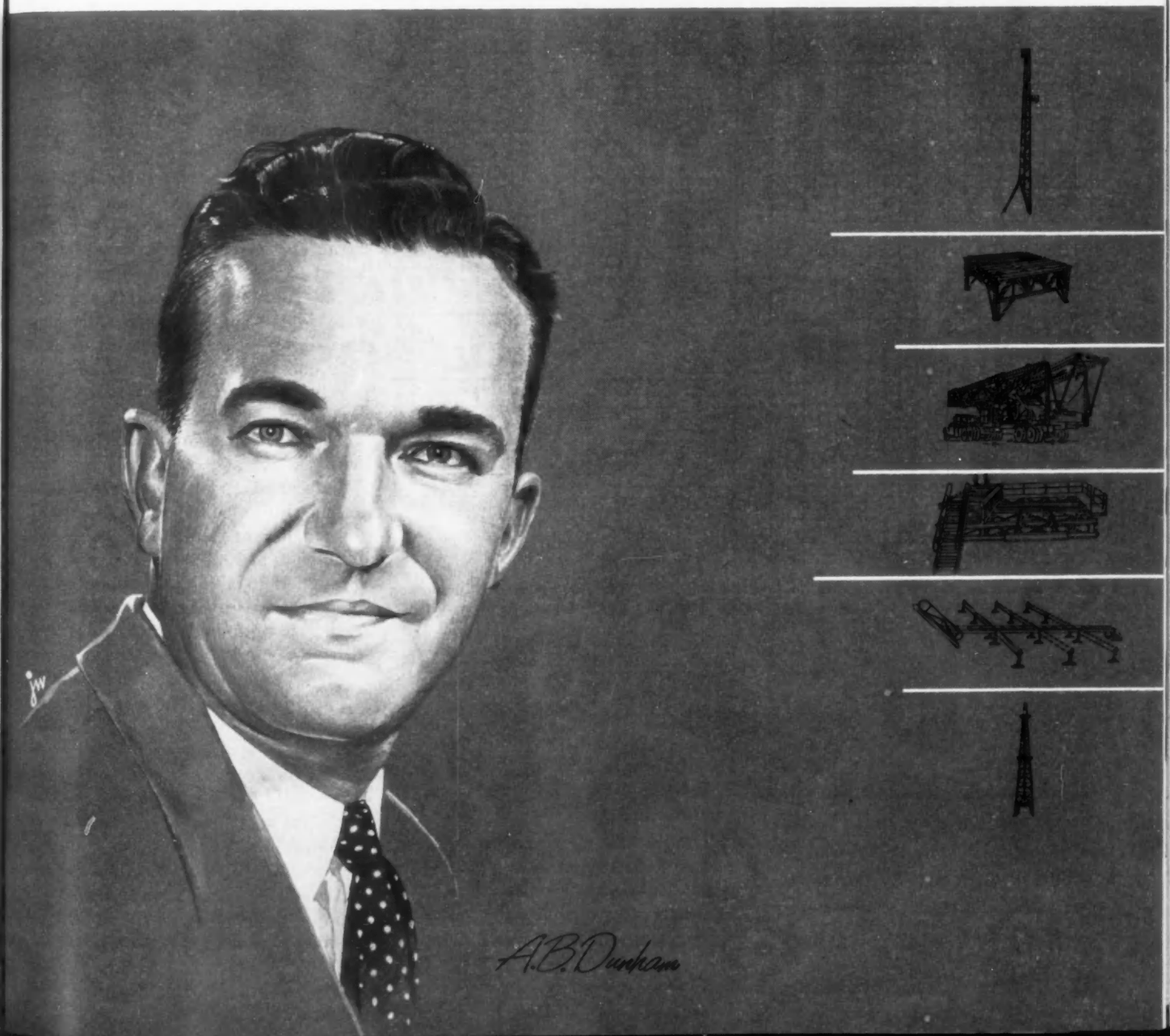

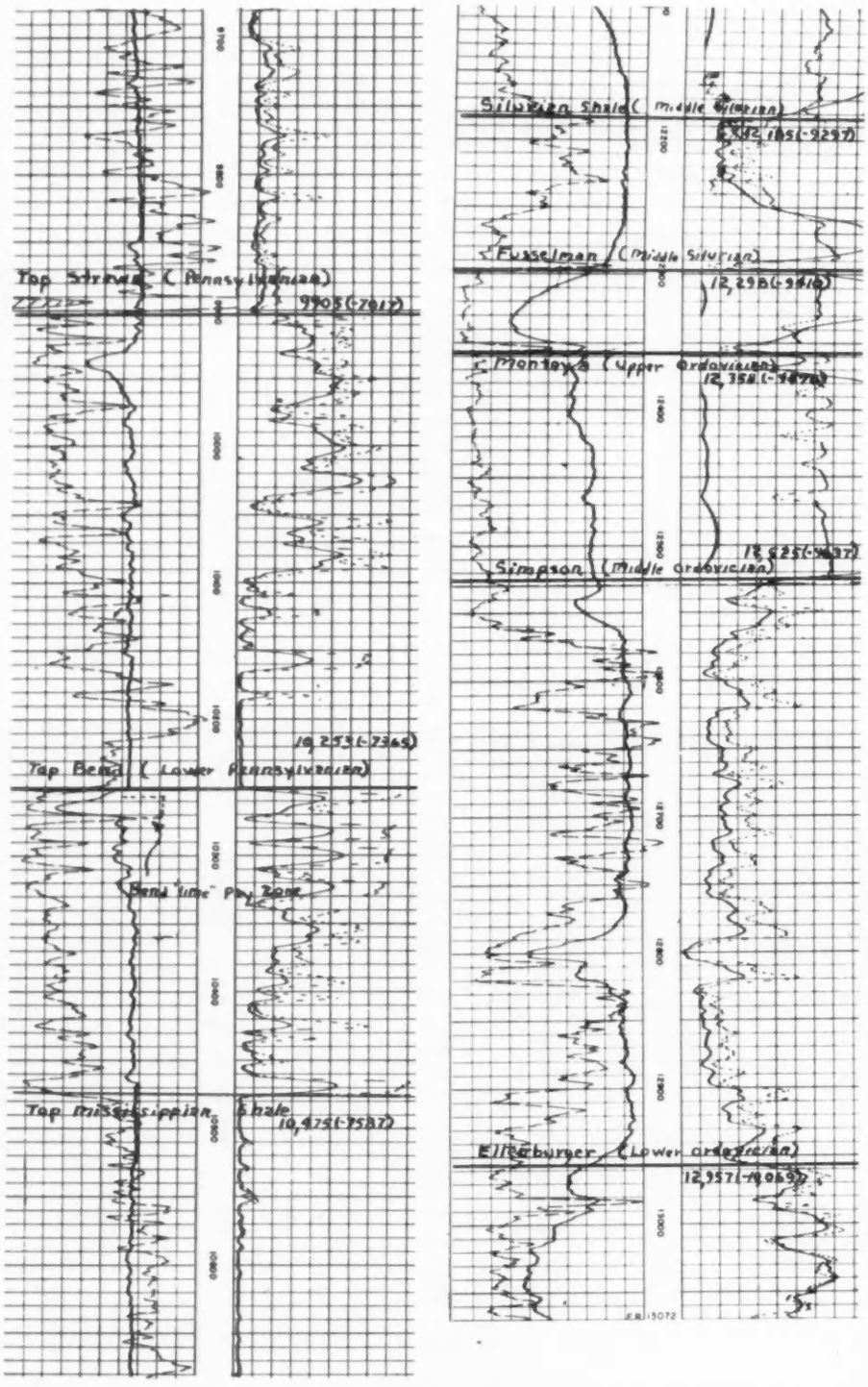

FIGURE 3—Electric log of pay sections in Dora Roberts "B-3" No. 1 of Forest Oil Corporation and Cities Production Corporation, Midland County, Texas.

rotary speed of 55 to 60 rmp, and 35,000 pounds of weight to total depth. The average deviation from the vertical of the bore hole in the field normally may bear from ½ degree from surface to 3 degrees at 9200 feet. From a depth of 9200 feet to approximately 13,300 feet the hole may deviate from 3 to as high as 5 degrees from the vertical.

The mud characteristics are such as to maintain proper hole conditions while drilling and to insure good mud character for the carrying out of a testing and coring program. A typical program followed in the field is described below:

Depth Ft.	Mud Conditions
0 to 4800 feet	Fresh water native mud. Viscosity about 33 to 35 seconds.
4800 to 9500 feet	Fresh water native mud with the addition of leather fiber and gel oil for loss circulation, viscosity 33 to 35 seconds.
9500 to 10,200 feet	Wt. 8.9 lb. per gal., Vis. 38-45 Sec., water loss 9 cc., filter cake 2/32-in., Gel chemical mud.
10,200 to 10,550 feet	Wt. 9 lb. per gal., Vis. 45 Sec., water loss 9.6 cc., filter cake 2/32-in., Gel chemical with wt. material and maximum of 10% oil.
10,550 to total depth	Gel chemical mud with maximum 10% oil, Wt. sufficient to control Pennsylvanian (Bend), Vis. 90-120 Sec. to control shales, water loss 9-10 cc., filter cake 2/33-in. If high pressures are not encountered in the Bend Section weight should be reduced as low at 8.9 lb. per gal. to prevent formation break-down of the Devonian and Ellenburger groups.

Approximately 300 feet of 13⅜-inch surface casing is set and cemented with 250-300 sacks into the red beds of the Triassic, and the cement circulated to ground level. This depth for the surface casing is so selected to assure the proper protection of all fresh surface waters and any stray water sands that may develop. In drilling to the surface casing seat, only one 17½-inch bit is required.

After the surface casing is set, the hole size is reduced to 12¼ inches and drilled to approximately 4800 feet with an average of 12 bits required. This second string of casing, known as the intermediate or "salt string," 9⅝ inches in diameter, is cemented with 1500 to 3000 sacks of cement and circulated to about 1700 feet, or top of the anhydrite and salt section. The casing is bottomed in a sandy anhydritic grey and buff dolomite known as the Grayburg formation of the Guadalupe series. The main function of this string is to case off the salts, anhydrites, red beds and sands of the Guadalupe series, upper Permian in age.

A 7⅝-inch liner is generally cemented about 9200 feet in the Wolfcamp lime, lower Permian in age, with 900 sacks of cement and the slurry circulated to approximately 4400 feet to tie in with the intermedi-

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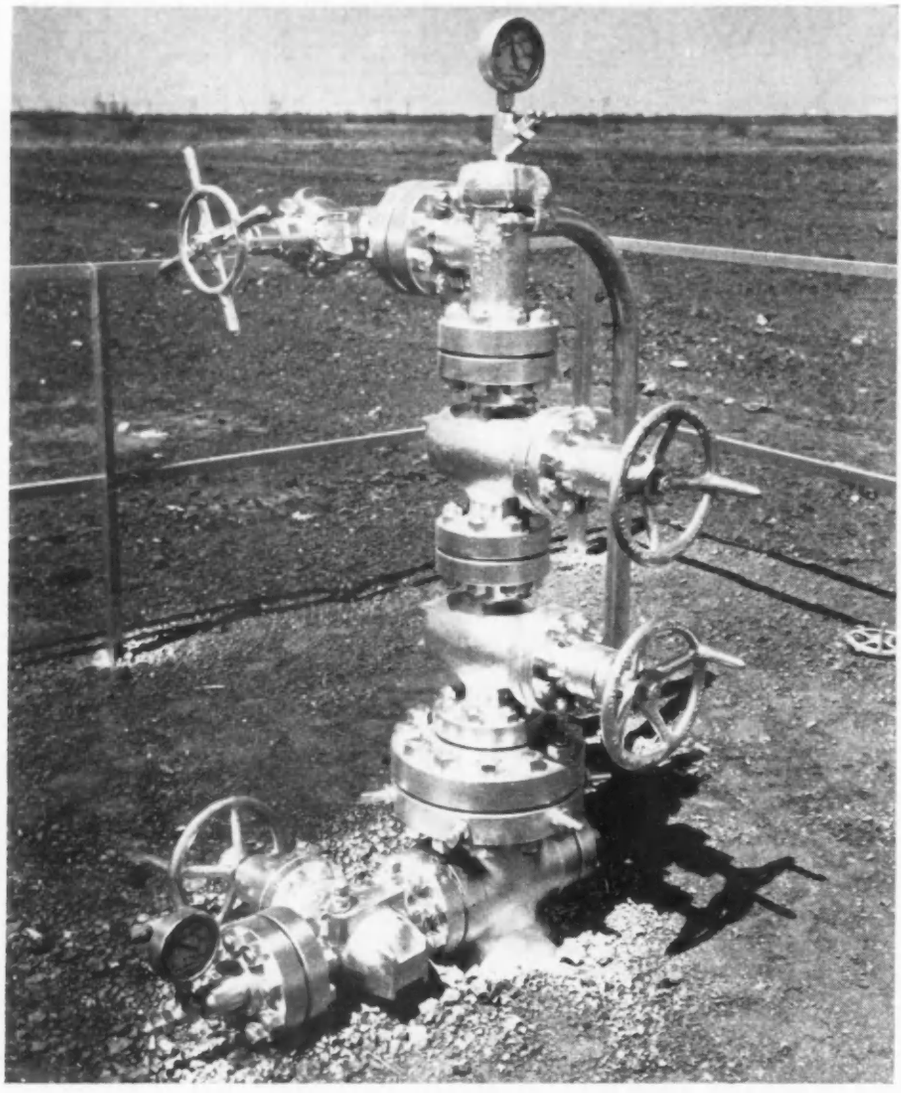

Typical wellhead hookup for recent completions in the Virey-Ellenburger trend. Flowing pressure is in the range of 1250 pounds per square inch, with casing pressure at about 800 psi.

ate casing. From under the intermediate string the bore hole is reduced to 8¾ inches, and requires 40 bits on the average.

The purpose of this string is to seal off the San Andres, dolomite and lime body of the Lower Guadalupe series normally averaging 600 feet in thickness and carrying "oolitic" and vugular porosity often causing lost circulation in the area. The San Andres is penetrated with water and an added mixture of gel oil and leather fiber to seal off this porosity.

Mud is not used due to the expense and the factor of losing the drilling fluid into the formation. Not only does the San Andres formation cause loss of circulation at this depth of 9200 feet, but the Spraberry sand of the lower Leonard series, has the same effect.

Some operators have found on drilling into the upper Wolfcamp that the well may encounter shows of considerable gas and oil. This formation, consisting of a light brown and white fossiliferous lime with very dark brown shale partings, and shale stringers, is fractured throughout with little or no porosity. Although gas and oil may appear on the surface after penetrating several feet of this zone, the formation has not proved productive to date in the Virey Trend.

The production string is set approximately 13,200 feet with 500 sacks of cement in a hole size of 6¾ inches that was drilled from below the 7⅝-inch liner, with an average of 58 drilling bits. This long string is normally set after penetrating the Ellenburger formation from 10 to 20 feet. This procedure is followed due to the character of the Ellenburger formation in the area. The Ellenburger formation being porous and highly fractured tends to "take" the drilling fluid thereby causing loss of circulation.

To overcome such conditions and prevent possible "blowouts" from both the Pennsylvanian and Wolfcamp zones the standard practice is to set casing at this point. This practice also eliminates dissolution of the formation by the weight of the drilling fluid used to overcome gas and oil zones of the Pennsylvanian and Wolfcamp formations. Some operators have found that the Ellenburger formation may be penetrated without first setting the production string. However, the general practice is to set casing upon entering the Ellenburger formation.

After the long string has been run, the well is "drilled in" with a hole size of 4⅝ inches. Normally, the small drilling bits will average 20 feet per bit. Thus 5 to 10 bits may be required to drill the Ellenburger pay. No definite amount of pay section is defined in the field due to difference of opinion on what is a sufficient amount for a good commercial well. The amount of pay normally cut is from 50 to 200 feet of gross pay section. Net pay is seldom figured due to the fractured condition of the Ellenburger group. The only controlling factor involved in the amount of pay section is based on the oil-water contact in the field. The water table has been established by the Warren Wallin No. 1, at minus datum of 10,513 feet. Most operators will try to stay at least 100 feet above this datum.

After a sufficient pay thickness is drilled, 2-inch tubing is run, and the well is acidized for completion. Normally, the tubing is set about 50 feet above the total depth of the well, and the formation washed with an average of 1000 gallons of mud acid, then with regular acid consisting of from 5000 to 20,000 gallons. When the well has been properly treated, a swabbing unit is used to start the well flowing. After a potential is taken, the rig is moved off and the well head assembly installed.

Normal procedure for completion of the Pennsylvanian formation is to

line

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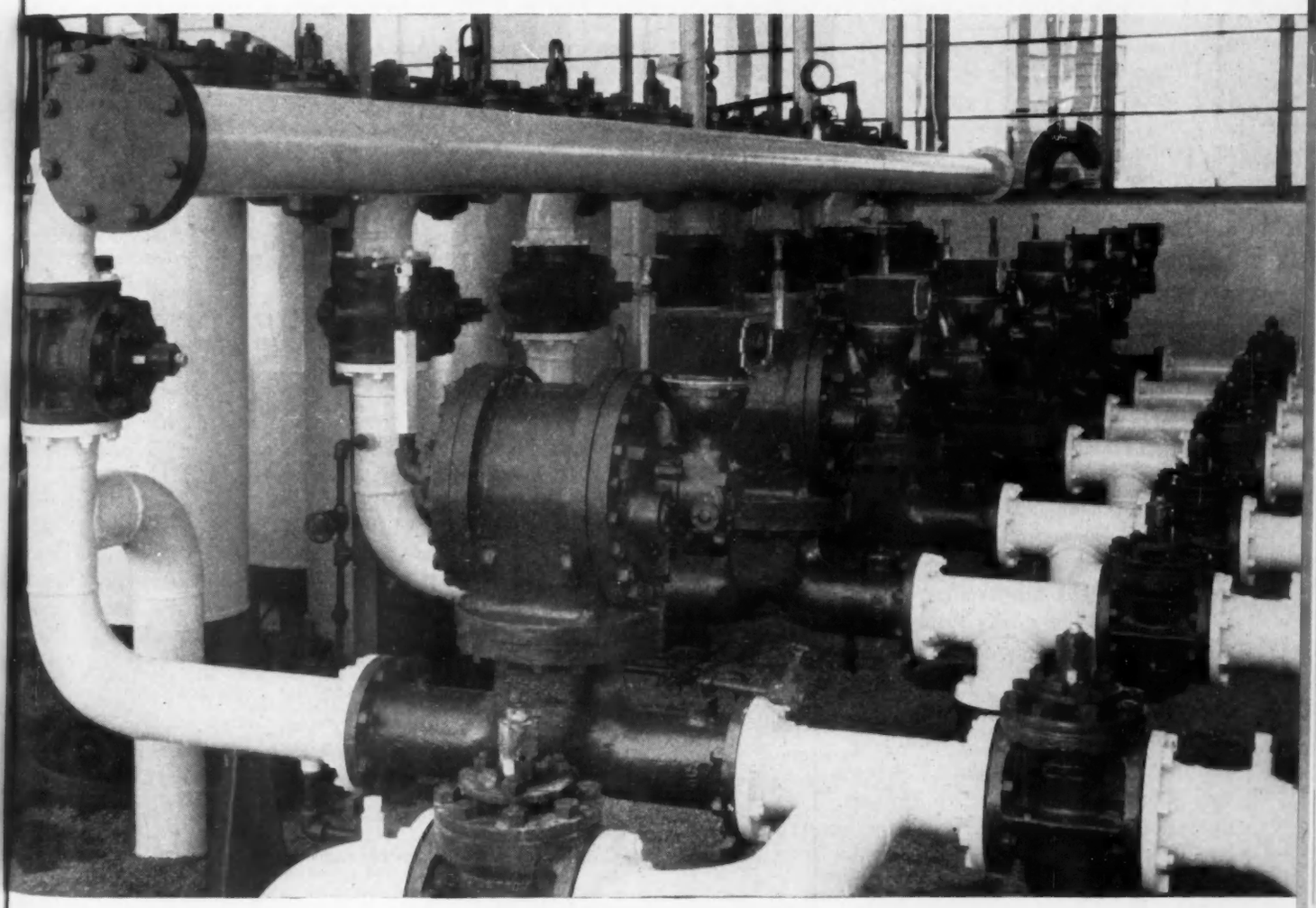

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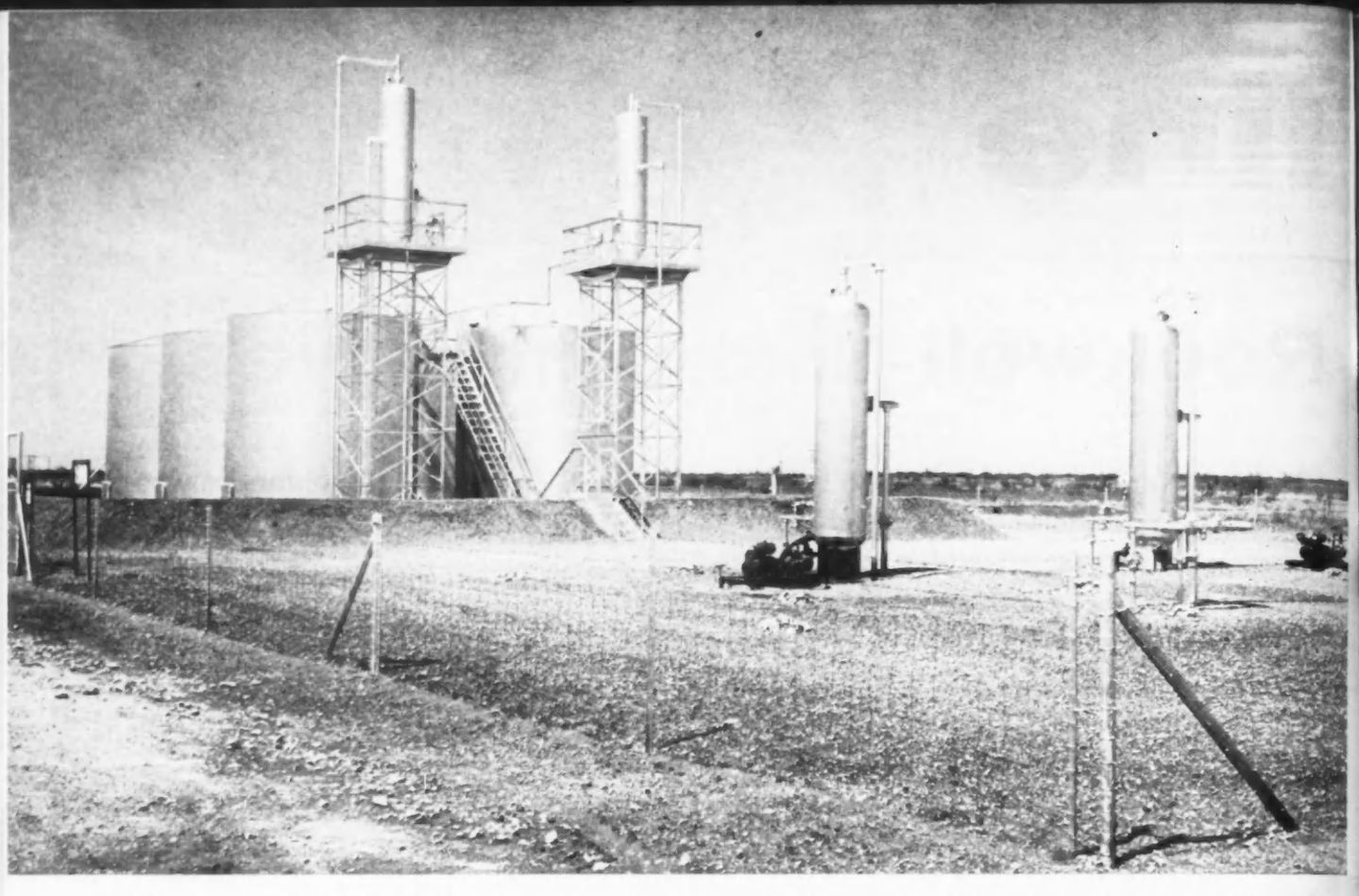


Size of tank batteries in the Virey-Ellenburger trend is indicative of production. This particular battery in the Headlee field contains six 1000-barrel stock tanks.

set through the pay and then perforate the section. This is accomplished by setting 5½-inch casing and cementing it with approximately 125 to 300 sacks, and then washing the formation with 1000 gallons of a mud dissolving acid and 4000 gallons of regular acid.

The average pay thickness of the Pennsylvanian may vary from approximately 6 to 15 feet or none at all! The Pennsylvanian pay zone is one of porosity development and is very erratic. This porosity development is the controlling factor on Pennsylvanian completions for the field. The operators in the field are hesitant about drilling wells only to the Pennsylvanian formation because of this factor.

Development to be continuous. With the active drilling program set forth by Forest Oil and Cities Production Corporation by the continuous operation of six drilling rigs, these trend fields will experience rapid development. At the present time 10 drilling wells are active in the trend, 4 in the Virey Field, 4 in the Dora Roberts Field and 2 in the Warsan Field. As further wells are drilled in the area, existing structures with added new complexities will be extended along with the possibilities of new pay zones being opened for production.

In the foregoing discussion, the potentialities for production from the Strawn, Devonian, and Lower Wolfcamp formations was mentioned. Not only these formations may prove to be potential reservoirs for gas and oil, but the San Andres and Grayburg may develop possible pays along the trend. In conclusion, the number of wells drilled and completed have just scratched the oil reservoirs. With further development the Virey Trend may soon become one of the "hottest spot lights" of oil and gas development in the Permian Basin.

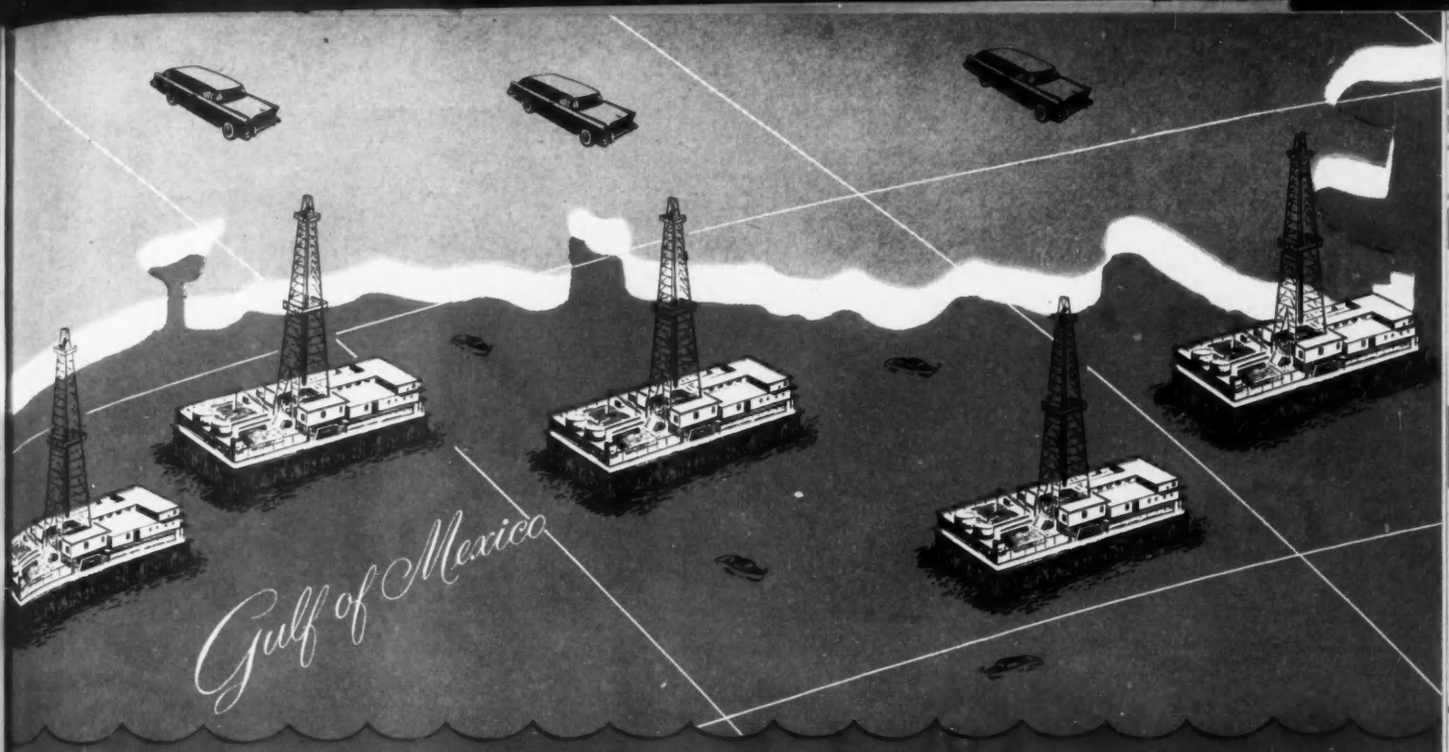
About the Author

JAMES R. (DICK) SIMMONS is assistant district geologist for the New Mexico district of Warren Petroleum Corporation, with headquarters in Midland, Texas. A graduate of Texas Western College in 1951 with a B.S. degree in geology, he worked briefly with Rotary Engineering Company of Midland as a logging engineer before joining Forest Oil Corporation in 1952 as staff geologist. He served as exploitation geologist in charge of development of the Roberts Ranch since its purchase by Forest and Cities Production Corporation in 1953. He has held his present position with Warren Petroleum since April, 1955.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to the management of Warren Petroleum Corporation for permission to publish this article and to the geological staff of the West Texas and New Mexico division for their constructive criticism. Grateful acknowledgments are offered to Fred Stead of Ada Oil Corporation for his comments and to Forest Oil Corporation, Warren Petroleum Corporation and Llano Drilling Company for the technical information found in this report.

—The End



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A WEST TEXAS-NEW MEXICO FEATURE

Looking northwest near south end of Fuller-Coke portion of Jameson Strawn field. Note the difference in elevation of rig on hill (right in photo) and rig in the valley. This topography is typical of much of the area.

New Strawn sand discoveries are being found throughout Eastern Shelf area of the Permian Basin of West Texas. Activity has reached boom proportions in . . .

The Jameson-Strawn Sand Trend

By FRANK B. CONSELMAN, Consulting Geologist, Abilene, Texas

THE AMERICAN DOMESTIC oil producing industry appears to be in the process of erecting yet another monument to its courage and determination out on the Eastern Shelf of the Permian Basin of West Texas, where a major oil field has now taken shape in Coke, Mitchell and Sterling counties, some 40 miles northwest of San Angelo.

At a time when the industry has become increasingly concerned with the economic effect of crude imports upon the domestic market, and in the face of continued curtailment of allowables and uncertainty as to what the national and local political future will bring in the way of taxation and

Looking northeast from central portion of Jameson trend toward the Colorado River and Jameson Reef field near Silver. Every acre in this picture is now producing.

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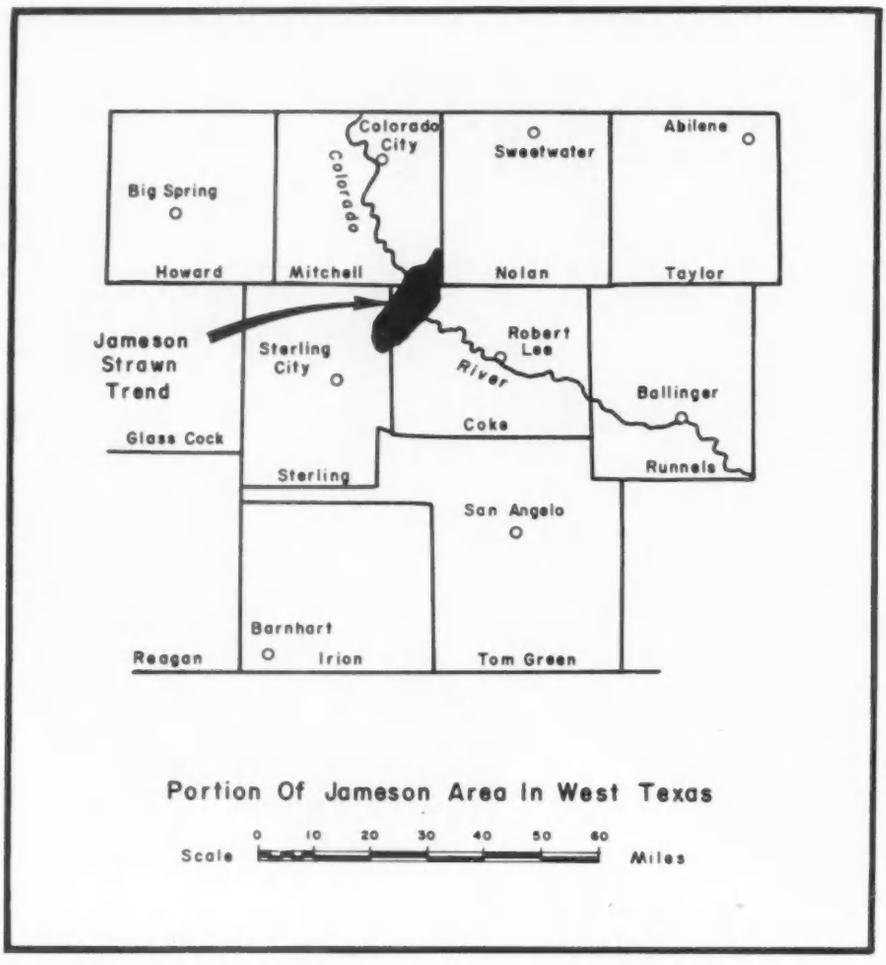


Portion Of Jameson Area In West Texas

regulation, West Texas oilmen have demonstrated a dogged willingness to go after the "tough barrel," and to make it pay.

As a result, a Strawn sand producing area with a length of at least 18 miles, and having a width of almost five miles, extending diagonally across the northwest corner of Coke County into adjacent portions of Mitchell County to the northeast and Sterling County to the southwest, appears to be proved for production. The essential continuity of all of the producing zones along this trend was confirmed by the Texas Railroad Commission on April 1, when the majority of the pools formerly recognized were consolidated in the Jameson Strawn field. This merger brought the support of statistics to subsurface geological data indicating the existence of a major sand reserve in the Lower Pennsylvanian Strawn series on the Eastern Shelf.

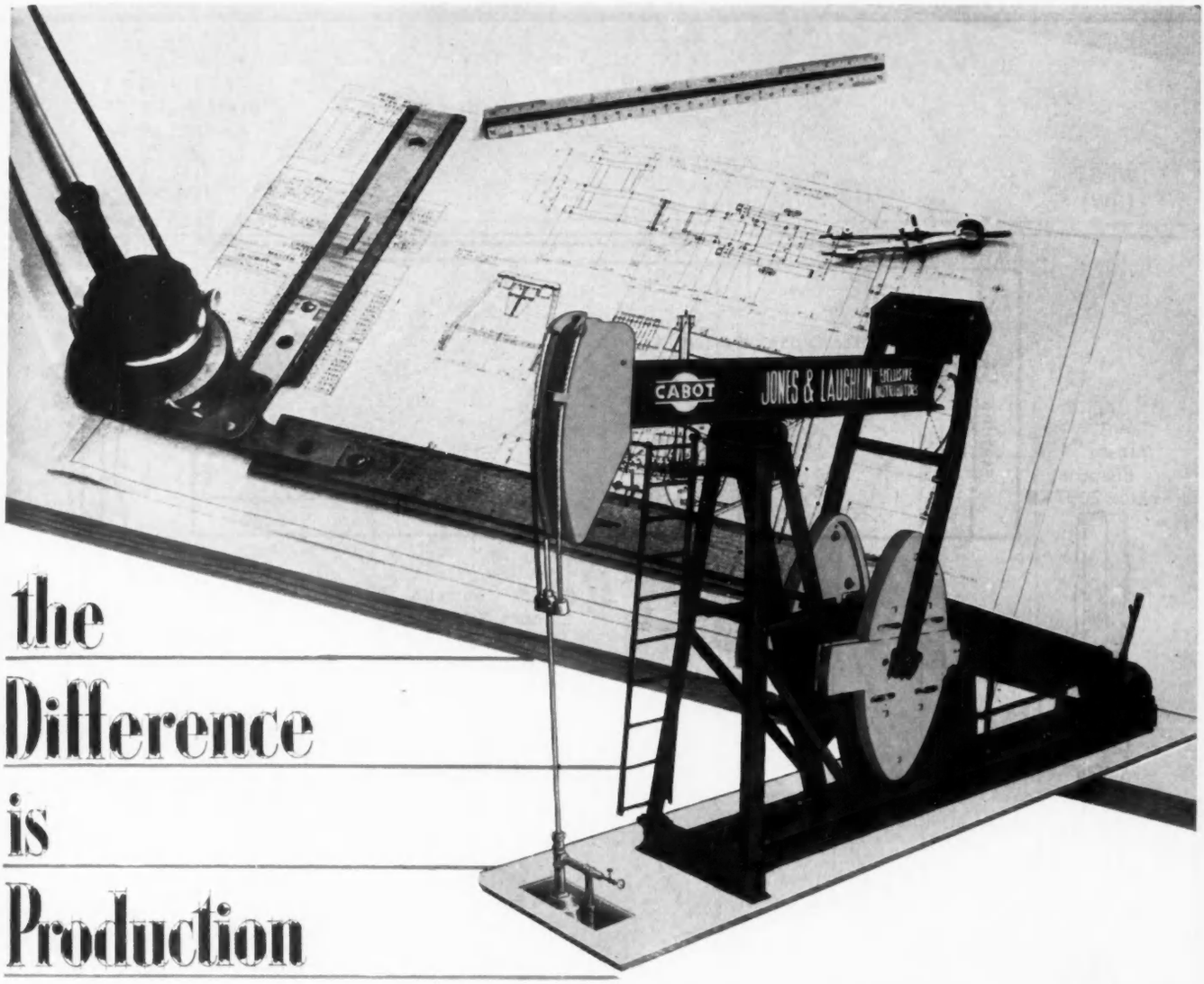
During the period of less than 3½ years since active development of the Strawn trend began, over 400 producers have been completed in three counties, and cumulative production is well over 6½ million barrels of oil. Virtually all of this development has taken place in Coke County, but the field is still undefined not only downdip to the northwest, but southwestward into Sterling County, where important discoveries have been made in 1955, and northeastward across the southeast corner of Mitchell County, where only offset extension would be necessary to add a part of Nolan County to the producing area. Obviously leasing activity has not been awaiting actual drilling, and at this writing the land play in the trend area is probably as intensive as anywhere in West Texas.

Strawn a misnomer. Actually, the term "Strawn" in the official name of the Jameson-Strawn field appears to be a misnomer. There is an increase amount of geological evidence that these sands are not of Strawn, but of Canyon age—the Canyon series being immediately above and younger than the Strawn. Pending publication of palentological data, this article will continue to use the present designation of the producing sands, some of which in the lower part of the section may prove to be actually of Strawn age. For the time being, it might be well to drop the word "Strawn" from the field title, and refer to this production as Jameson Sand production.

Production history. The story of the Jameson "Strawn" sand development necessarily dates from the discovery of the Jameson Strawn limestone reef, with the completion of Sun No. 1 Allen Jameson, in December, 1946. The Jameson reef was rightly hailed as one of the principal fields of the Eastern Shelf, and development of reef production was carried out progressively by the operators. In the process of outlining the reef reservoir, discovery of production in the sands flanking this northeast-southwest-trending limestone mass became inevitable, and many of Sun's reef producers logged oil and gas showings in the relatively thin sands above the main lime pay. It was not realized at the time that eventually these "flank" sands would prove to underlie a vast area far exceeding that of the reef itself, and that Strawn sand production would completely overshadow the recovery from the reef responsible for its discovery, and from which it gets its name.

The Jameson Strawn sand reservoir was officially recognized for proration purposes following the completion of Chester Hunter No. 1 E. E. Stagner, at a location about three miles southwest of Silver townsite and a half mile east of the Colorado River, which winds across the Jameson trend. This edge location proved to be critically located with respect to reef production, being well down the northwest flank of the limestone mass. After setting oil string in the top of the reef at 6350 feet, the test was plugged back and perforated in sands between 5925 and 6095 feet, and completed after a light fracture treatment for a flowing potential of 140.8 barrels daily through ¼-inch choke on 2-inch tubing, receiving an emergency allowable for the discovery month of January, 1952.

Actually, this "discovery" was by no means the first Strawn sand producer in the vicinity. During the summer of 1948, A. G. Hill completed R. W. Harris Estate No. 1 for a commercial well in a Strawn sand apparently equivalent to the chief permeable sand perforated in Hunter Stagner No. 1, at a location in the so-called Lygay area, less than three miles southeast of the latter well, and just



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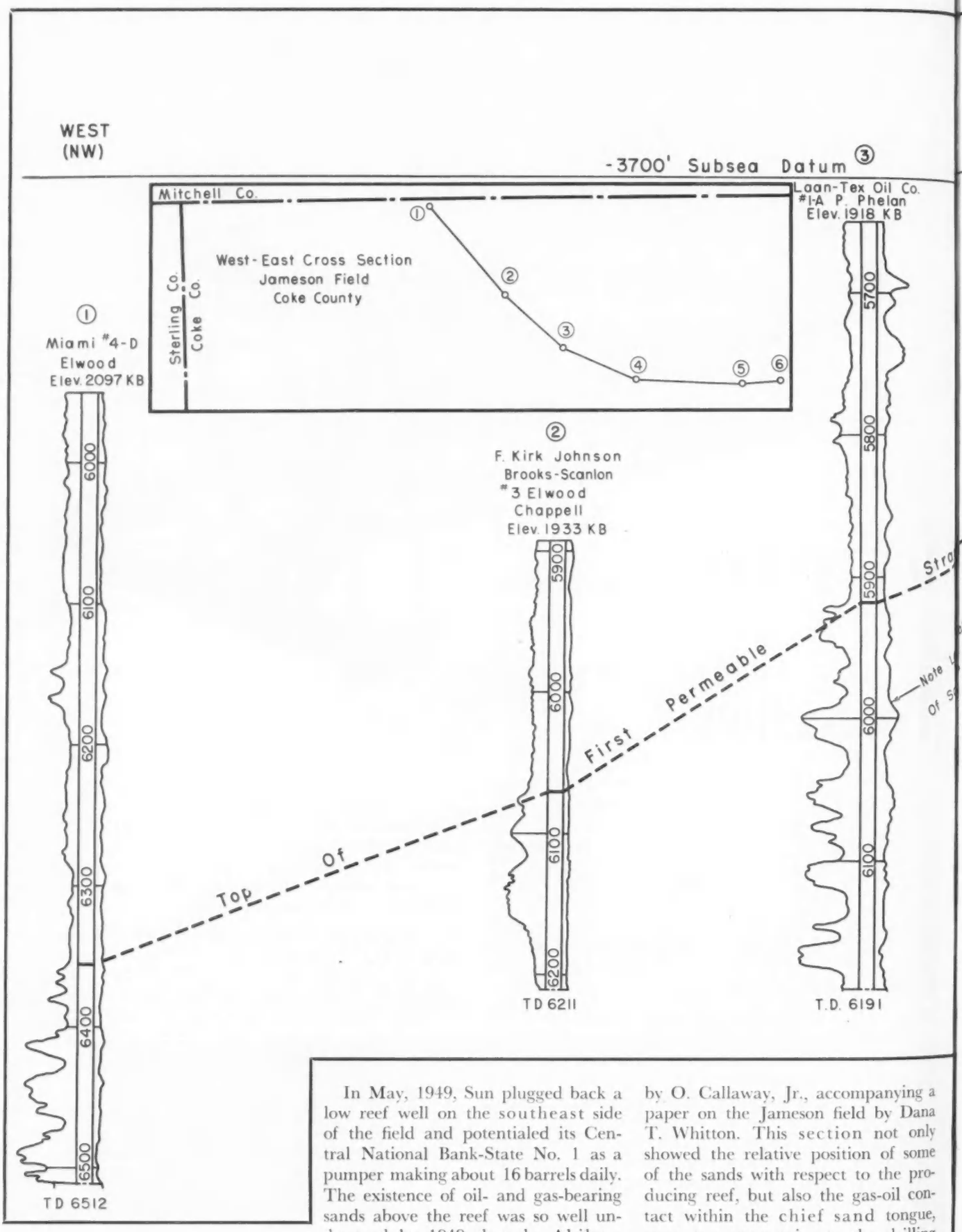
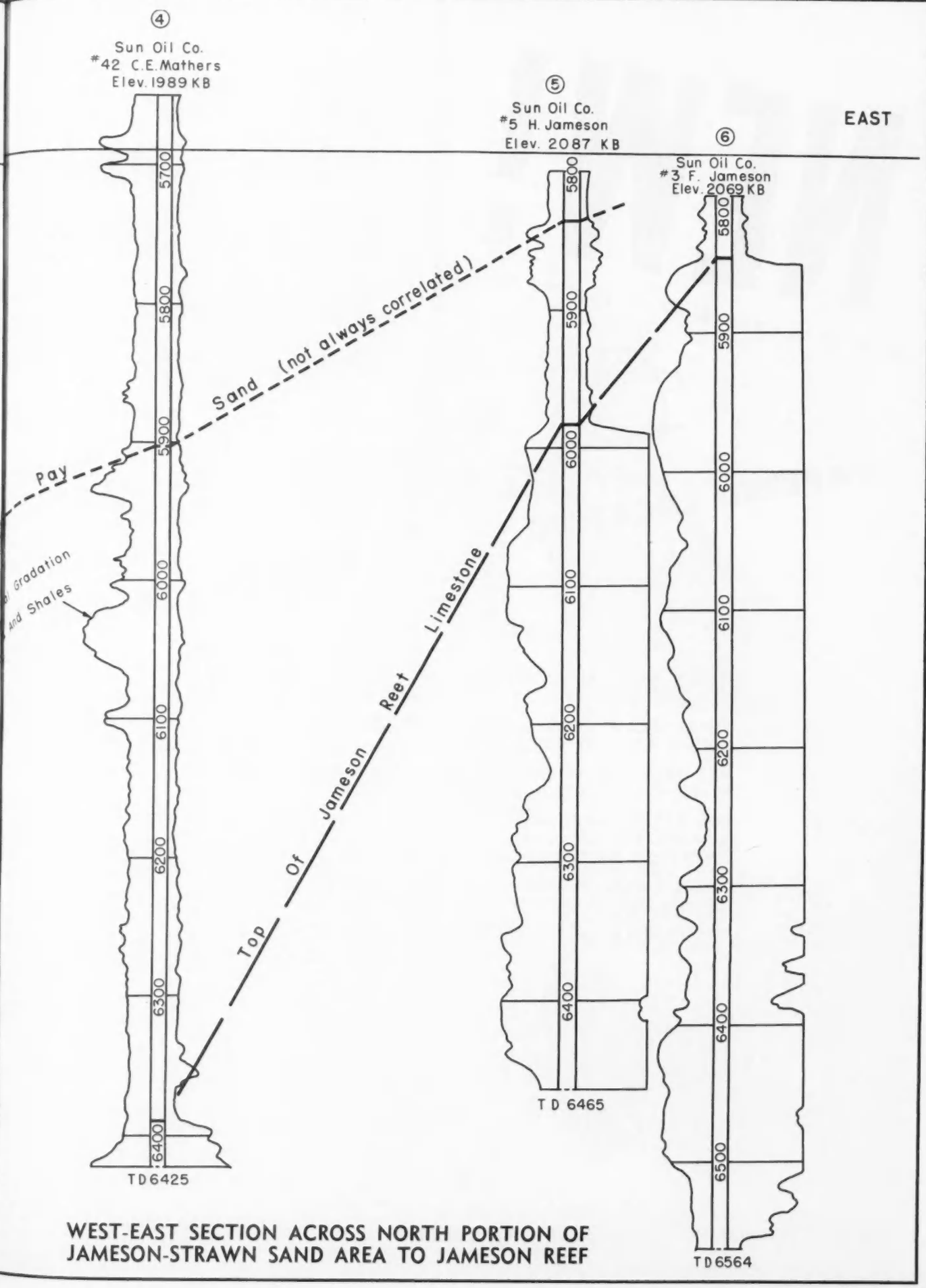


east of the south end of the Jameson reef. Subsequent Strawn sand wells were completed shortly thereafter on this lease.

In May, 1949, Sun plugged back a low reef well on the southeast side of the field and potentialed its Central National Bank-State No. 1 as a pumper making about 16 barrels daily. The existence of oil- and gas-bearing sands above the reef was so well understood by 1949 that the Abilene Geological Society published in its 1949 Structure Study Group Symposium a cross section titled "Strawn Reef and Flank Sand Development," by O. Callaway, Jr., accompanying a paper on the Jameson field by Dana T. Whitton. This section not only showed the relative position of some of the sands with respect to the producing reef, but also the gas-oil contact within the chief sand tongue, some two years prior to the drilling of the actual "discovery" well of the Jameson Strawn pool.

Development of flank sand production on the northwest side of the reef



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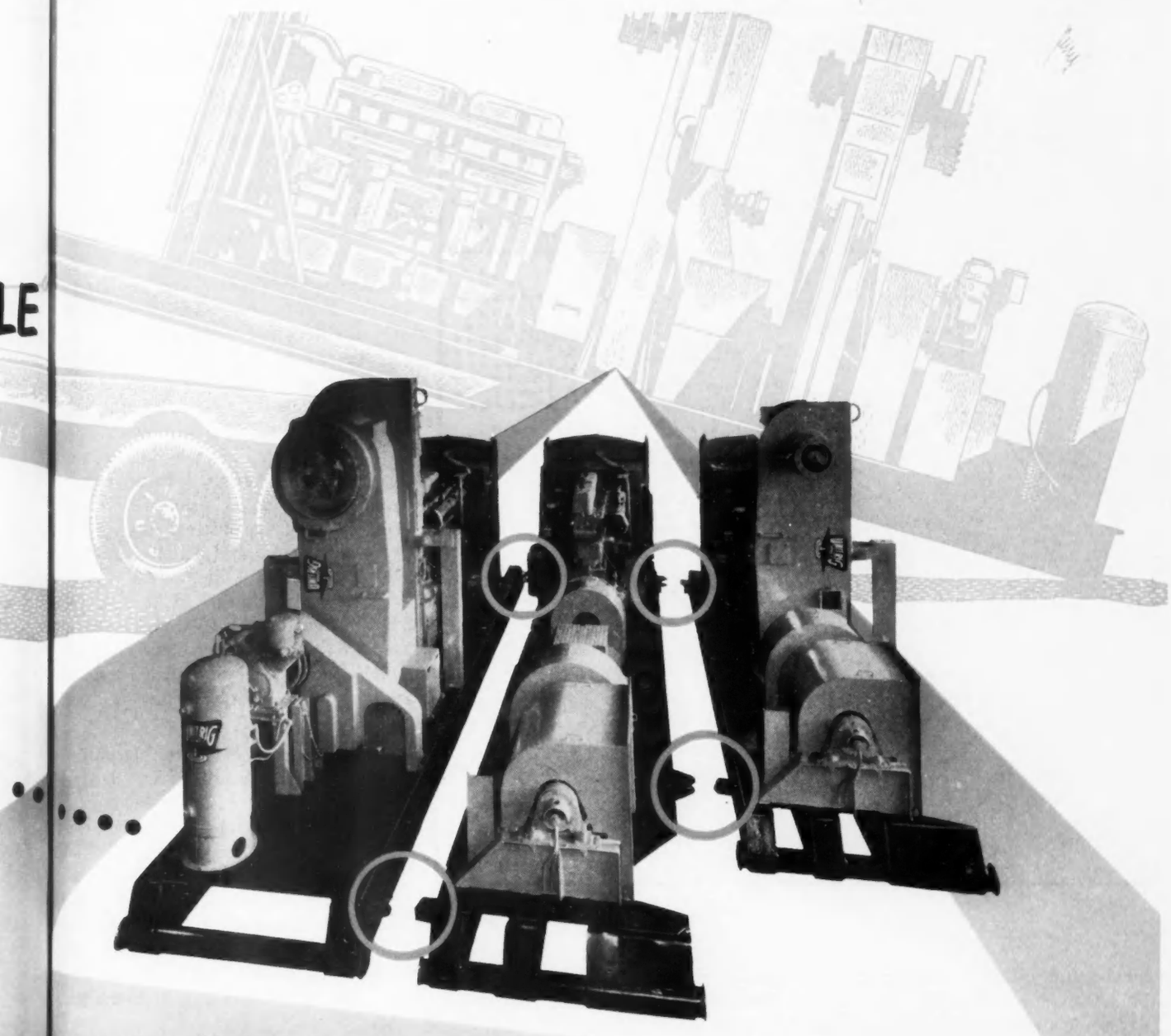

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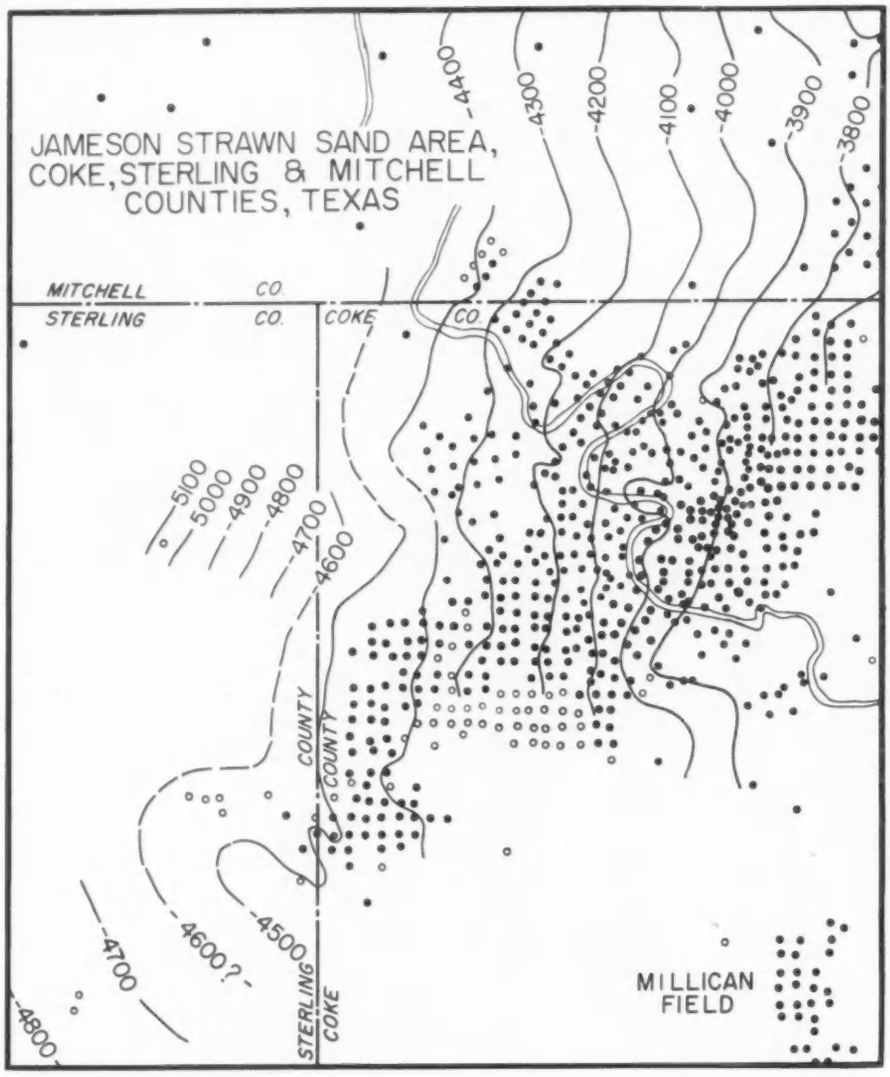

thus became merely a matter of time, the first exploration phase of the sand play being a byproduct of reef drilling.

In April, 1951, Sun completed its Bloodworth No. 2 at a location two miles east of the crest of the Jameson reef, as the discovery well of the one-well "Bloodworth 5700 feet sand field." This completion, eight months prior to the Hunter Stagner No. 1, was of interest in demonstrating that Strawn sand production was not necessarily limited to the opposite side of the Jameson reef.

Immediately following the completion of the Hunter Stagner No. 1 early in 1952, officially opening the Jameson Strawn field, Sun twinned a number of its reef wells in the immediate vicinity as sand producers, and development then proceeded in an orderly manner as the field extended from offset to offset. At the time it was assumed that the Strawn sands were probably localized reef flank deposits of limited distribution, and it was expected that they would soon become water-bearing downdip, or pinchout completely. Inasmuch as the reef production was already well established as a major field, very little attention was paid to the gradually expanding sand area, which continued to spread laterally along the reef and downdip to the northwest, despite the fact that core analyses revealed the various sands to be tight and of low permeability, with unimpressive recovery estimates.

In January, 1952, the first month of Jameson Strawn sand production, the reef produced 262,592 barrels of oil, while the new discovery produced 1073 barrels. One year later, in January, 1953, reef production had increased to 302,263 monthly barrels, while the sand wells had slowly augmented to 72,646 barrels. In March, 1953, Sun and Amerada made an important joint discovery in the southeast corner of Mitchel County, at their V. T. McCabe, 1½ miles north of the Coke County line and about one-half mile west of the Nolan County line, and some two miles north of the northeast end of Jameson reef production. A very important stepout was completed in October of the same year in the opposite direction, when W. M. & A. P. Fuller completed their Lou E. Johnson No. 1 in an entirely undeveloped area some four miles southwest of the nearest reef production and a mile and a half east of the Sterling County line. This well, in C/SE/NE Section 67, H. & T. C. RR. Co. Survey, Block 2, was the discovery well for the Fuller-Coke pool, now included in Jameson Strawn, and resulted in at least doubling the sand producing area.

By January, 1954, monthly production of the Jameson reef had declined to 208,434 barrels, while Jameson Strawn jumped to 183,623 barrels, and the new Fuller-Coke Strawn field made 11,806 barrels. Thus these two Strawn fields by that time had almost equalled the monthly producing rate of the older reef pool. The older Lygay sand field, discovered in 1948, added an additional 5543 barrels to the sand total.

By January, 1955, the Jameson reef had been completely outclassed by the sand fields. The reef wells, many of them unitized, produced 205,682 monthly barrels. Meanwhile Fuller-Coke Strawn, Fuller-Coke South Strawn, and Fuller-Coke Northwest Strawn had a combined production of 100,957 monthly barrels, which added to Jameson Strawn gave the sand fields a total of 492,448 barrels, or almost 2½ times as much as the older reef.

Early this year, two important discoveries were made to the west and southwest in Sterling County, which finally brought the district the national attention which was long overdue. On February 15, W. M. & A. P. Fuller potentialed their W. R. Davis No. 1 for 353 barrels daily flowing through ¼-inch choke from perfora-

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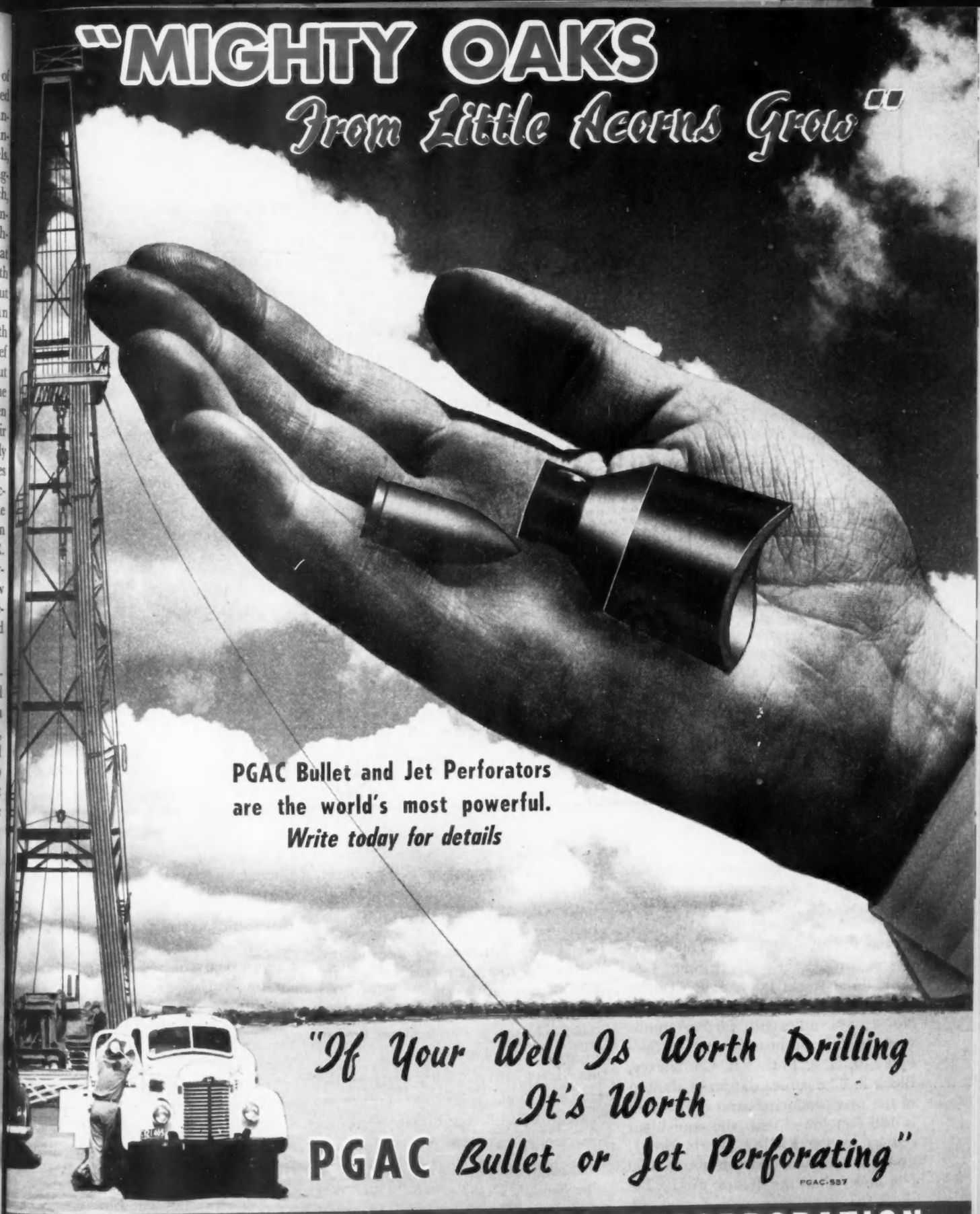

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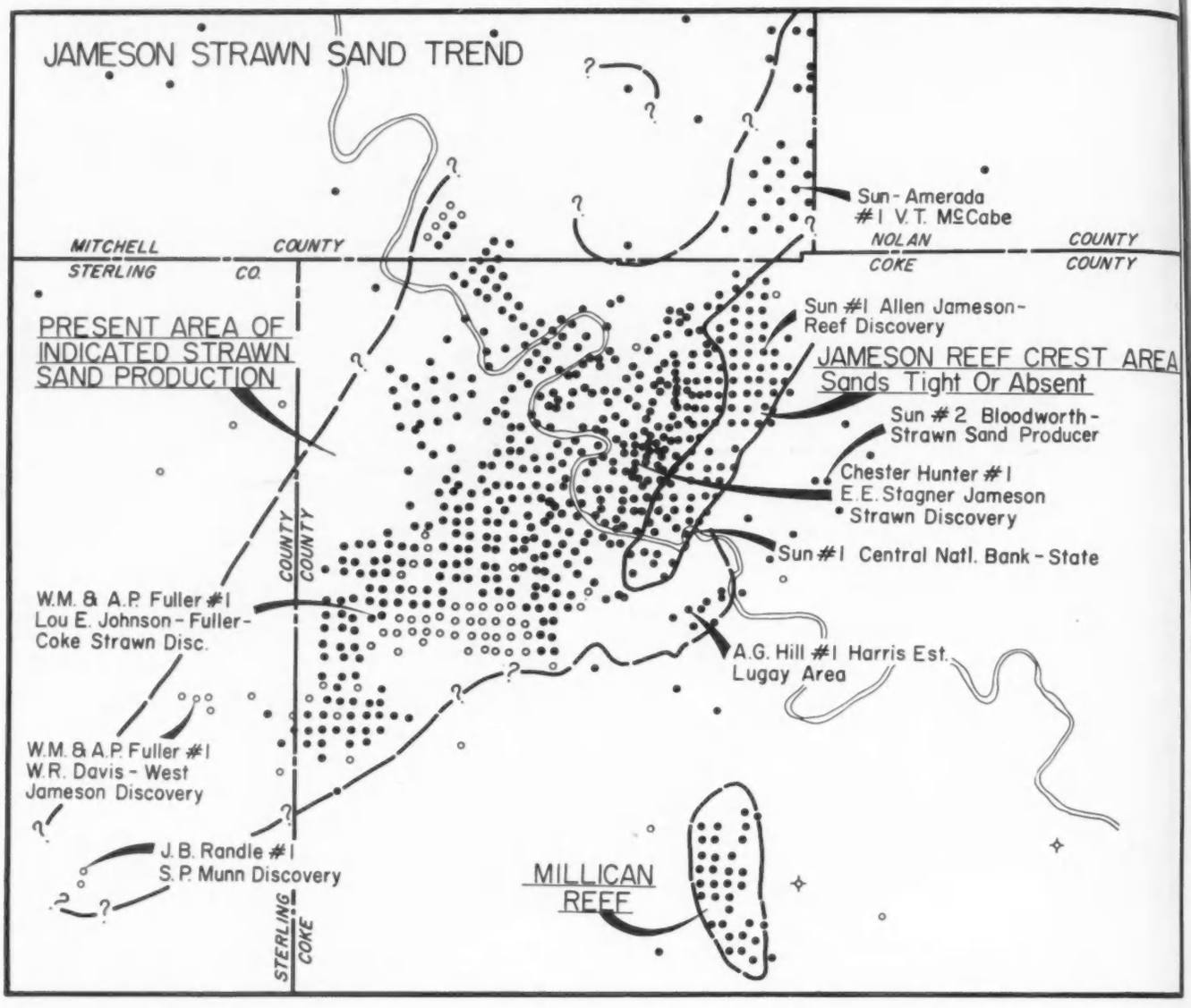


tions between 6874 and 6950 feet. This well, the discovery for the West Jameson area, was a stepout of 2½ miles west of the Fuller-Coke pools, and at this writing has two completed offsets, with other wells drilling. Less than three weeks later, J. B. Randle filed a potential on his S. P. Munn No. 1, 3½ miles still farther southwest, in the southeast corner of Section 170, H. & T. C. RR. Co. Survey, Block 2. The subsea datum of the top of the first producing sand in this well is 186 feet lower than the equivalent datum in the Fuller Davis No. 1, above mentioned, and just about 1000 feet lower than the highest producible sands in the Jameson reef area. A south offset to this well is now drilling, and a wildcat stepout two miles to the west is also under way.

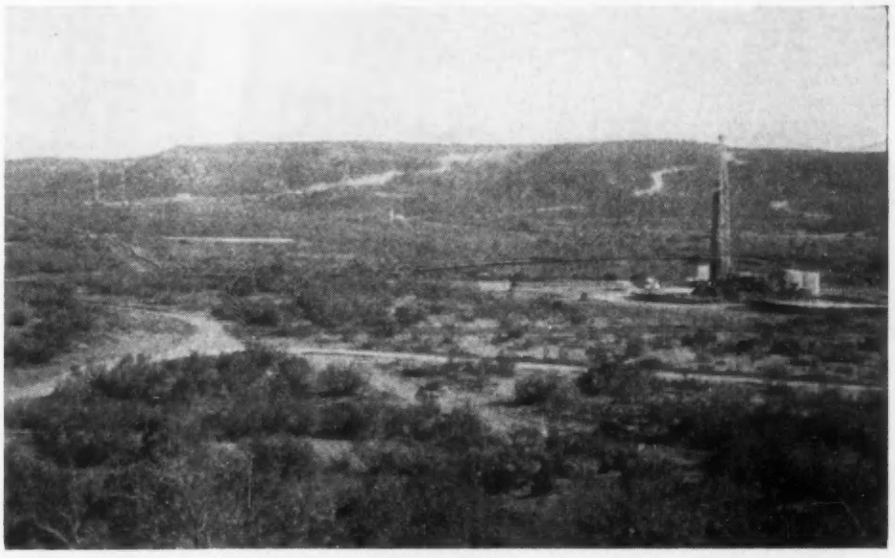
The combined Jameson Strawn sand pools have thus taken shape as one of the most important Permian Basin developments since Spraberry, with which it is becoming increasingly compared. As a matter of fact, the comparison, during the early stages at least, favors Jameson, which produced during the first 28 months of its history a cumulative total of 3,693,091 barrels of oil, from Jameson Strawn alone. During a comparable period, the Spraberry had yielded 2,903,155 barrels, or only 79 percent of the Jameson total.

In January, 1955, the various Strawn sand fields of the Jameson trend were producing at a rate of 6 million barrels per year. This rate, now considerably increased, is about equal to the 1954 production of the State of North Dakota, and substantially exceeds the yearly outputs of Ohio, West Virginia, and New York. If development continues along the Jameson trend at the present rate, these figures will be far surpassed by the end of the year.

Geologic setting. The producing section consists of a series of tight, fine-grained sands distributed through an interval of grey-black shale, several hundred feet thick. First oil sands range in depth from 5900 feet near the reef to about 7350 feet near the Randle well in Sterling County, with much of the production encountered in the middle 6000's.

These sands are generally lenticular, and it is difficult to correlate them for any distance without interruption. They tend to coalesce locally along the edge of the reef, but usually exhibit independence from other stringers penetrated in the same well, so that each zone must be perforated and fractured individually. As many as 5 or 6 sands may be productive in a single well. Individual pays are

Continued on Page 153



Looking south near discovery well in the Fuller-Coke pool. Rig in right foreground is Humble Oil & Refining Company's Lou E. Johnson Estate 8. Note three lease roads running through hills in background. At left of photo is pipe line under construction. It is a gathering line for Texas Natural Gasoline Corporation's new plant.

generally less than 40 feet thick, and the combined over-all sand thicknesses range from non-commercial amounts up to 100 or 200 feet. Effective pay, a difficult and sometimes arbitrary determination, may exceed 100 feet locally, but this is exceptional. Each sand may have its own water-level, and many wells are producing oil below the subsea water datum of updip leases. There is no evidence of an effective water drive, and dissolved gas appears to be the chief source of energy, aided in the highest wells by gas-cap expansion.

Undoubtedly these reservoirs must be classed as stratigraphic rather than structural accumulations, trapping being effected by updip pinchout of the various sand lenses. The role of the Jameson reef in localizing production now appears to be much less important than originally supposed. Sand distribution apparently took place widely across a fairly shallow Strawn sea floor, on which reef growth in the Jameson and Millican areas was simultaneously taking place.

Presumably the reefs maintained sufficient topographic relief during the period in which they were formed to provide a barrier which modified and locally controlled sand deposition. However, it is now known that many producing sands exist that are not directly related to the Jameson reef or any other known reef mass. On the other hand, the Millican reef, a few miles south of the Jameson reef, does not have comparable flank sand development. It will be recalled that sand pays have been found not only on the northwest flank of the Jameson reef, but also in the Lygay pool at its south end and in the Bloodworth area two miles east of the reef crest.

The Strawn sand trend now extends 10 miles southwest, 3 miles north, and 4 miles downdip northwest from the Jameson reef, and far exceeds the area in which local reefs may be considered to have exercised sedimentary control. Perhaps both reefs and sands may be interpreted as contemporary phases of shallow sea deposition. The conditions under which they both were formed appear to have been sufficiently widespread to make it reasonable to expect that more reefs and more sands remain to be found in the region.

A valuable paper on the Jameson Strawn sand has been written by Don Riddle of Stanolind Oil & Gas Company and is published in the 1954 Geological Contributions Volume of the Abilene Geological Society.

Drilling and production. The Strawn sand fields of the Jameson

Looking south through the Fuller-Coke portion of the Jameson Strawn producing trend. All of this rugged terrain is now productive.

Temporary production hookup on the newly-completed Superior Oil Company Knight 1 in West Jameson area of Sterling County. This is south offset to discovery well. Rig in distance is W. M. & A. P. Fuller's west offset to their discovery, now drilling.

This rig is running in the new extension area between south part of Fuller-Coke and West Jameson. Location is Warren Petroleum's H. M. Knight et al. 2 in Sterling County.

trend are being developed on a 40-acre pattern, modified locally by irregular surveys along the Colorado River and rough topography, particularly in the Fuller-Coke area. Wells are put down in about 5 or 6 weeks by rotary rigs using conventional mud fluids, with considerable difficulty in many areas from contamination by salt water flows. Standard practice is to set 500 or 600 feet of surface casing, penetrate all known potential pays and set 5½-inch oil string through them, then complete after perforating and fracturing. Fracturing is often massive and apparently indispensable in almost all cases for adequate recovery.

In addition to being remote and distant from any large towns, local terrain adds to the difficulties of access to the area. The Colorado River can only be crossed at a few low-water fords, and there are no bridges across it anywhere in the 40-mile airline distance between Robert Lee and Colorado City. To the south and west the topography becomes quite broken and rough where the highland plateau is broken by valleys and box canyons draining down to the river. Hundreds of thousands of dollars have been spent on lease roads and locations, and dirt work is a major expense item, along with the usual West Texas difficulties with respect to water.

Between 20 and 30 rigs are now running in the Jameson trend area. So many undrilled locations in proven or semi-proven territory remain that economic rather than geologic factors will govern the rate of development during the near future.

Economic data. Jameson Strawn sand crudes are above 40-degree gravity, and are posted at $2.90 per barrel. Sun Pipe Line Company is the purchaser in the Jameson portion of the area, and Pan American Pipe Line Company takes the oil in the southern part of the field. Daily allowable is now 111 barrels per producing day,

Continued on Page 166

About the Author

FRANK B. CONSELMAN, a native of New York, holds degrees from New York University and the University of Missouri. He did graduate work at Harvard and Columbia universities, specializing in economic geology. He has been connected with the Missouri Geological Survey, Gypsy Oil Company, Gulf Oil Corporation, Great Lakes Carbon Corporation, and American Trading and Production in the Permian Basin, Mid-Continent and other areas. Since 1947 he has been a consulting geologist in Abilene, Texas.

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Drickey-Caprock Queen Sand Trend

By F. L. STEAD, District Manager, Ada Oil Company, Midland, Texas

THE SHALLOW 3100-foot Queen sand play in southeast Chaves County, New Mexico, has become the biggest shallow oil play in New Mexico in quite a few years. At the present time there are 12 major oil companies and 17 independents actively engaged in developing this trend which now extends over 30 miles along the northwestern shelf. (See Figure 1.) During the month of March alone, 27 rigs were running (both cable tool and rotary) and more than 20 field wells and stepouts were completed.

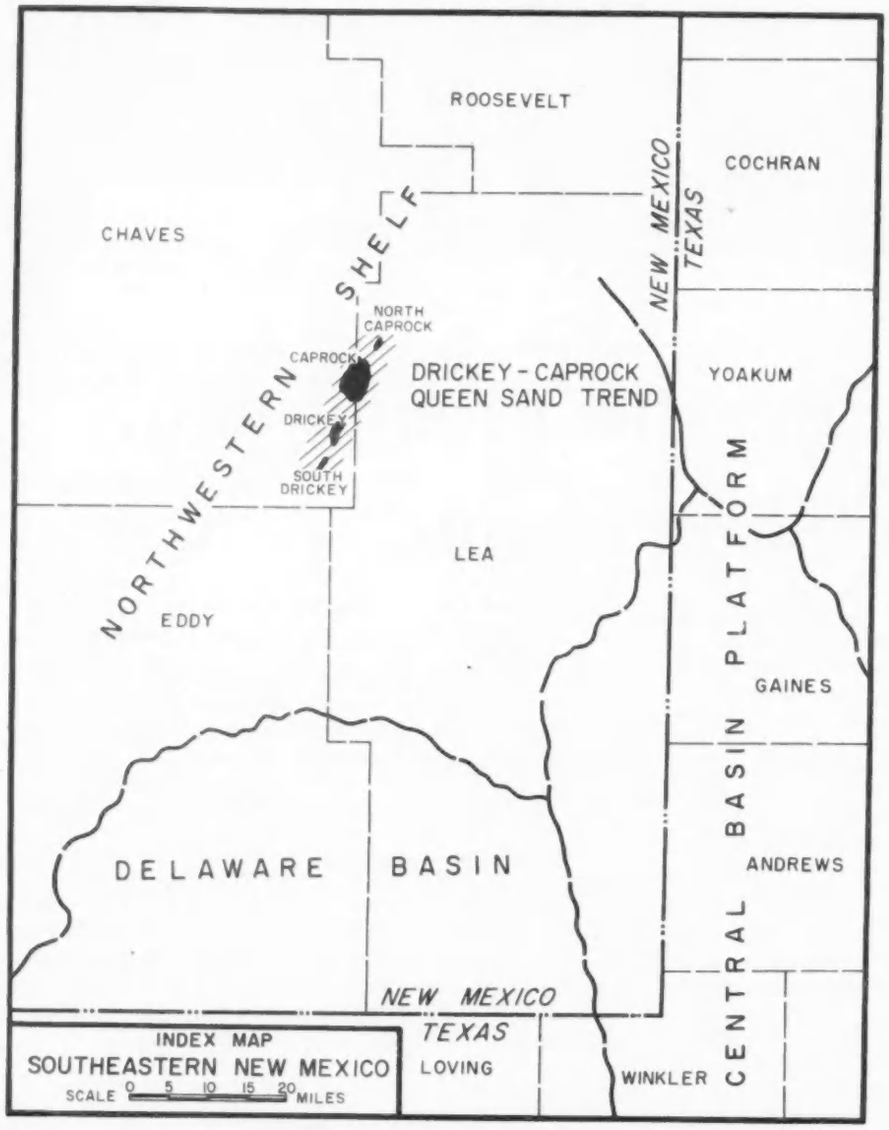
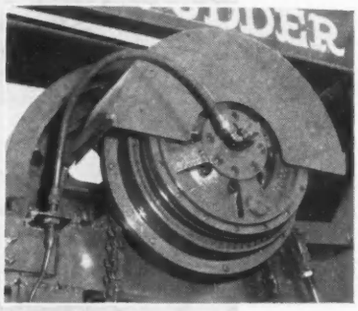


FIGURE 1—Index map of southeastern New Mexico showing location of Drickey-Caprock Queen Sand trend on Northwestern Shelf area in Chaves and Lea counties.

The Caprock field in Chaves and Lee counties was discovered in 1940 by the G. P. Livermore 1-D State well, Section 30, T-12-S, R-32-E, but active development was not begun until 1944. As of January 1, 1955, this field contained more than 130 wells and had produced a total of 4,284,675 barrels oil and 53,525 barrels water.

The Drickey Queen field was discovered in June, 1953, by the Neville Penrose 1-Zimmerman, located 3090 feet FSL and 1650 feet FEL Section 15, T-14-S, R-31-E, Chaves County, New Mexico. This discovery was located seven miles southwest of the old Caprock Queen field and was considered by many as unimportant. Subsequent development soon revealed, however, that the Queen sand section to the southwest responded well to hydraulic fracturing treatment resulting in high potential, water-free completions.

Regional geology. Regionally, the Queen formation in southeast New Mexico has an average thickness of 200 feet. It occurs over most of the Northwestern Shelf area, including the north half of Eddy County, north half of Lea County, and the southeast quarter of Chaves County. The Queen formation is Permian in age and occurs in the Middle Guadalupian series of the Upper Permian. Its lithology consists generally of dolomite and red or gray sand interbedded locally with anhydrite and salt. The uppermost



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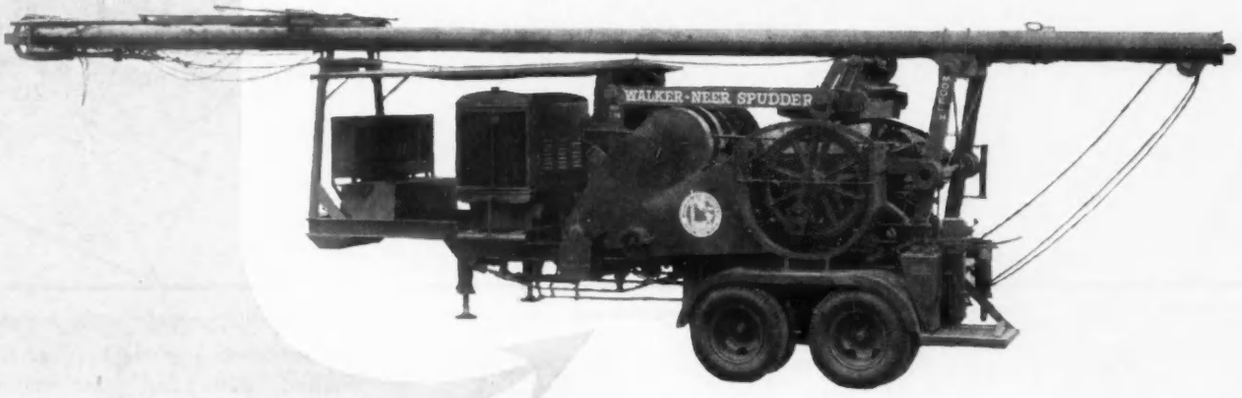

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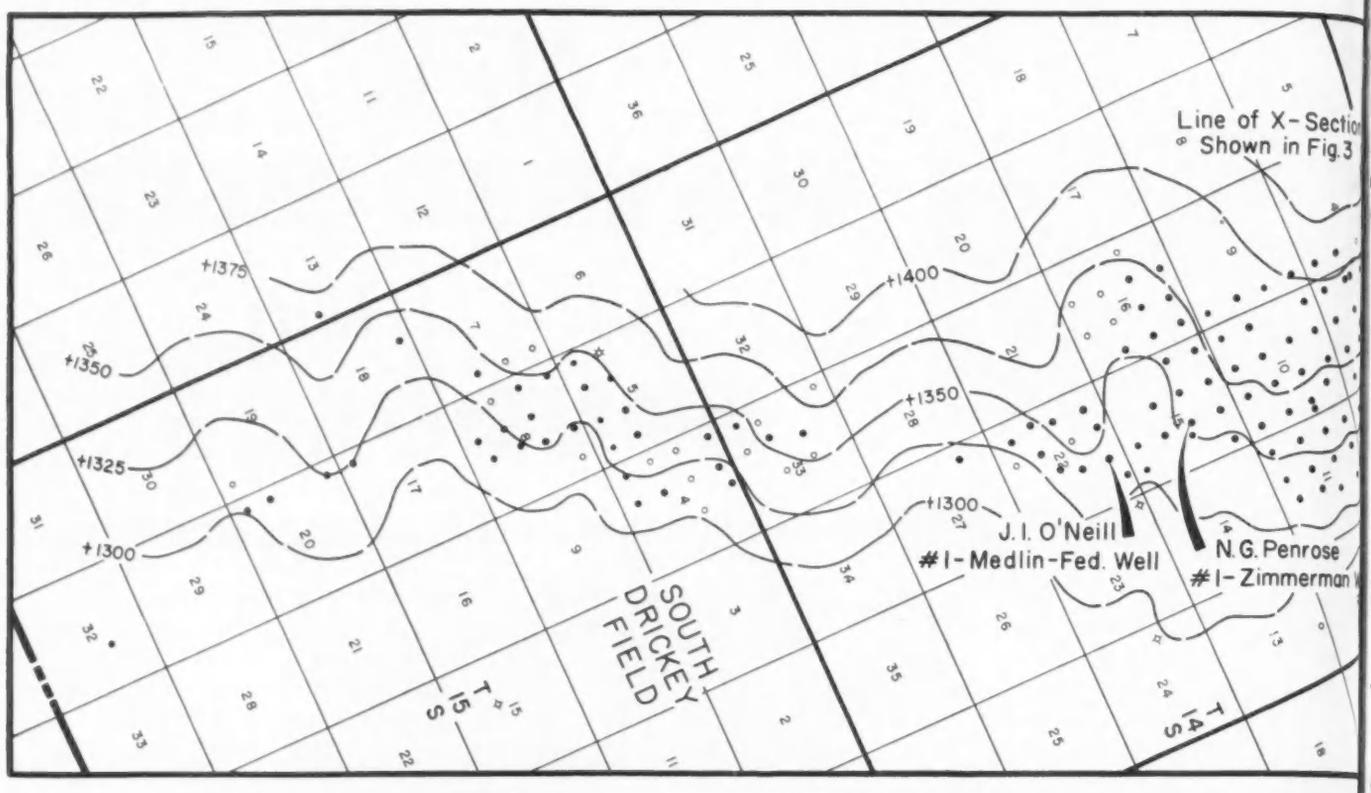

member is usually sand with numerous large frosted quartz grains. In the Caprock and Drickey fields this sand member is sometimes called the "Artesia red sand" or "Penrose sand" and has an average thickness of 25 feet consisting of very fine to medium grained calcareous sandstone interbedded with red shales and thin salt stringers. The regional dip is east southeast and averages 50 feet per mile. In the Drickey-Caprock trend these sands lie about 3100 feet deep. (See Figure 2.)

The Drickey-Caprock trend is producing from a stratigraphic trap. The porous Queen sands wedgeout updip to the west due to permeability barriers and/or facies changes. This wedgeout is usually found near the +1425-foot datum. The Drickey and Caprock fields are probably producing via solution-gas drive, and performance today indicates undersaturated conditions. The water table generally occurs near the + 1300-foot datum giving an average oil column of 125 feet. (See Figure 3.)

Lithology. The Queen Sand section ranges from 20-30 feet in thickness and averages about 25 feet throughout the trend. Of this 25 feet only two separate 6-foot zones produce, making an average total net section of 12 feet. A generalized description of the Queen sand section below the anhydrite casing point is as follows:

About the Author

FREDERICK L. STEAD is division manager for Ada Oil Company's Western division with headquarters in Midland, Texas. He studied geology at the College of Wooster, Wooster, Ohio from 1941 to 1943 when he entered the U. S. Army Air Force, serving as a B-29 navigator until his discharge in November, 1945. He returned to Wooster and received his B.A. in geology in 1947. He then entered the graduate school of the University of Texas. The following year he became an instructor and served on the geology faculty. He received his M.S. degree in 1950. In 1951 he joined the staff of Continental Oil Company in Midland and became district geologist in 1953. In February, 1954, he joined Ada and has been in charge of their West Texas-New Mexico operations since.

2-5 feet dense fine grained gray-tan sandstone, 6 feet soft friable fine grained saturated gray sand interbedded with salt stringers, 4 feet hard dense fine grained red sandstone, 6 feet soft friable saturated gray fine grained sand, and 2-5 feet hard dense red sandstone overlying more anhydrite. (See Figure 4.)

Many operators have attempted to core the pay zone in order to better establish a definite completion program. However, the pay zones in most places have been so "soft" that core recoveries are generally less than 50 percent and the intervals actually recovered are the harder, more tightly cemented sands which do not truly represent the "pays." Detailed core analyses available indicate the two pay zones have an average porosity of 15 percent, average permeability of 85 milidarcys, average water saturation of 45 percent pore volume, and average residual oil saturations of 10 percent pore volume. Several major companies have advanced the opinion that their estimated recoverable reserves by primary means are 150 barrels per acre foot or 72,000 barrels per well based on 40-acre proration units. The current allowable assigned these wells is 41 barrels oil per day based on a 30-day producing month. The Texas-New Mexico Pipe Line Company is taking the oil from the Drickey field, and Service Pipe

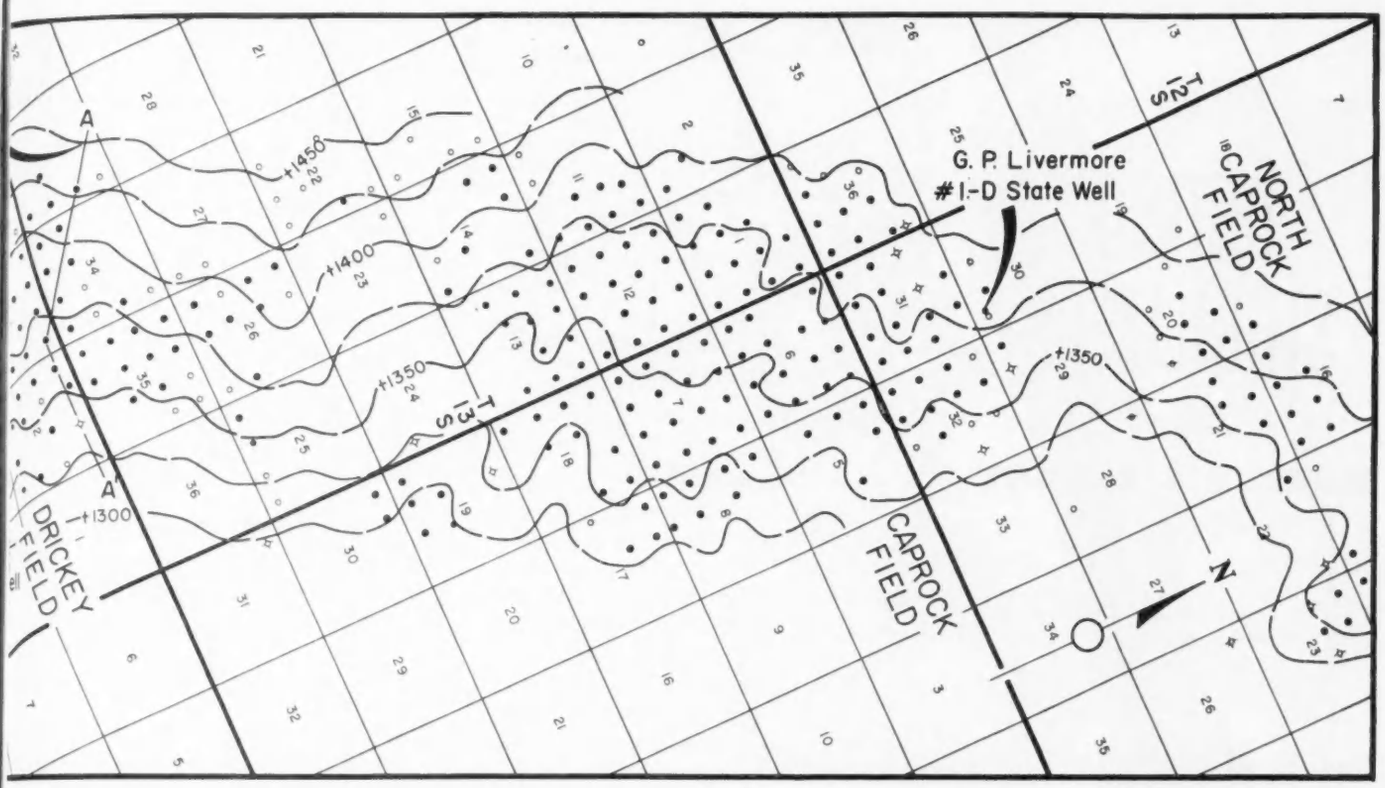

FIGURE 2—Trend map of Drickey-Caprock Queen Sand trend play. Contours are on top of the Queen formation, with a contour interval of 25 feet. Well completions shown are as of April 15, 1955. Map prepared by F. L. Stead and dated April 15, 1955.

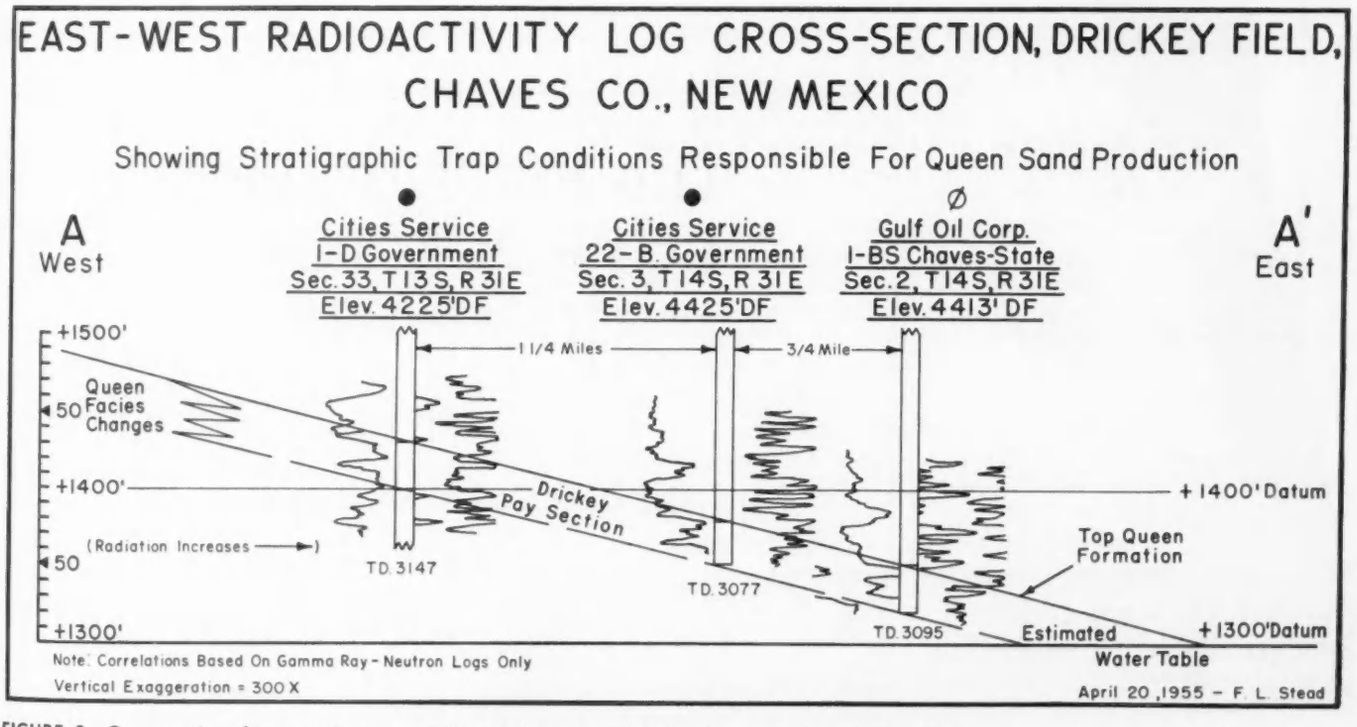

FIGURE 3—Cross-section shows up-dip permeability barrier responsible for Queen sand production in the Drickey-Caprock trend. This cross-section taken across A-A' on structure map in Figure 2.

Line Company is taking crude from the Caprock field

Drilling. Operators in the Queen sand play have used all types of drilling equipment. There are rotary, cable tool, and combination rigs currently in operation. The type of equipment used depends upon the preference and completion program of the individual operator. The most common tools in use are small rotary jacknife rigs. The average drilling time for these 3100-foot wells is 11 days using rotary tools. The average drilling time for cable tools is 25 days. Combination rigs have been averaging about 15 days drilling time. These averages do not include any completion time.

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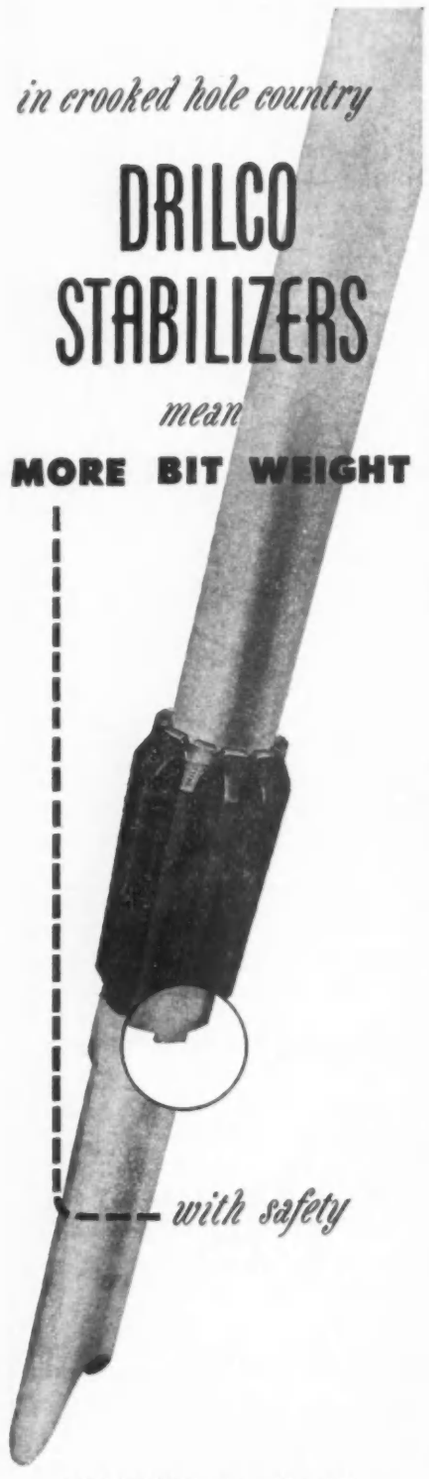

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crooked hole trouble, lost circulation, etc. After setting surface casing (usually around 300 feet of 9⅝-inch or 8⅝-inch), most operators drill these wells with clear water and native mud to the casing point in the 8-10-foot. Anhydrite section, immediately overlying the Queen sand. The interval, from surface casing to the pay, is predominantly an evaporite section containing anhydrite, dolomite, and salt interbedded with minor sands and red and green shales.

Completions. Completion practices used in this trend play have been varied. Many operators have followed the practice of setting casing in the anhydrite above the sand and then drilling into the top of the pay with cable tools. This makes a trouble-free natural completion but has two disadvantages: (1) It does not penetrate the whole pay section and allow the lower zone to produce, nor (2) is the completion adequate for future unitization and secondary recovery projects. These wells will then have to be deepened and recompleted.

A second type of completion practice currently being used involves

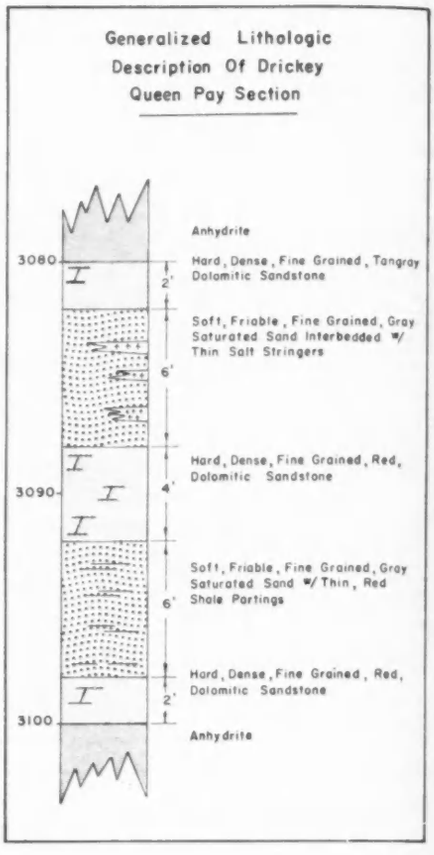

FIGURE 4

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drilling through the whole Queen sand section with an oil emulsion or low water-loss mud. Then the 5½-inch production string is set through the pay zone. Cementing, perforating, and mud acid treatments make natural completions difficult because cement invasion frequently blocks the pay zones. Fortunately, where this has happened, the wells have responded readily to fracture treatments.

The third type of completion is actually a combination of the two already cited. The complete Queen sand section is drilled with good oil emulsion or low water-loss mud and then the hole is logged. After logging, the 5½-inch production string is hung in the hole with a packoff shoe opposite the upper anhydrite. When the cement has cured, the shoe is drilled out and the well completed from open hole. This method does not endanger the pay zone in any way, nor does it run the risk of setting the casing too high above the pay before drilling in.

A majority of the wells in the Drickey-Caprock trend have been completed naturally. However, more and more operators are using hydraulic fracturing methods in their completions. Most fracturing is done in open hole using 8-10,000 gallons of lease crude and one half pound sand per gallon. The Queen sand crude is sweet, paraffin base oil, 37 degrees API at 60 degrees F. with sulfur content 1.07 percent and salt content 4.08 pounds/1000 barrels. The gas oil ratios are extremely low, ranging from 0-200. Only in several separate localities have small gas caps been found indicating the presence of normal three-phase reservoirs. The average bottom-hole pressure is about 1150 pounds per square inch.

Most wells completed naturally will flow for a limited time, six weeks at the most. Some wells after fracture treatment will flow as long as six months. In every case, however, they soon become pumping wells. Many operators install pumping equipment immediately following completion. This literally flows the wells by agitation and scrapers installed on the sucker rods help considerably in paraffin control.

Recently, some very prolific wells have been completed from this trend. Most notorious is the J. I. O'Neill 1-Medlin well, located in Section 22,

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T-14-S, R-31-E. This well flowed an estimated 135 barrels oil per hour through casing after the operator had drilled into the pay zone only two feet. Very few wells are of this caliber but the majority of recent completions will average 200 BOPD on initial potential tests.

Forecast. The producing limits of this trend are rather difficult to foresee. The Queen sand is known to extend from northeastern Eddy County across the southeastern corner of Chaves and on into extreme northern Lea County. Present development already has extended this trend to 30 miles in length. The four established fields: Caprock, North Caprock, Drickey, and South Drickey, are expected to coalesce into one long continuous producing area. The width of this producing belt has already reached three miles at several points. However, this trend is never expected to become wider than five miles. The length may eventually double its present dimensions and extend from the High Lonesome Queen field in northeastern Eddy County all the way to Roosevelt County, a distance of slightly more than 60 miles.

Many operators in this trend already are considering its secondary recovery prospects. A secondary recovery air injection project was initiated in the Caprock field in 1950 by the Cooperative Producing Association. The result of this pilot project indicated the increased amount of recovery could not be estimated accurately, but the additional recovery probably would equal the primary recovery of each producing lease. The large amount of data now available on the current water-flood project in the South Ward Queen Sand field of Ward County, Texas, and its great success, make the Drickey-Caprock trend especially attractive.

The Drickey-Caprock trend of southeast Chaves County, New Mexico, represents the first major stratigraphic trap-type play on the Northwestern Shelf area of the Permian Basin. It is believed that current development eventually will double this trend's current dimensions, as well as encourage other operators to drill deeper and thoroughly test this virtually unexplored corner of the Permian Basin. **—The End**

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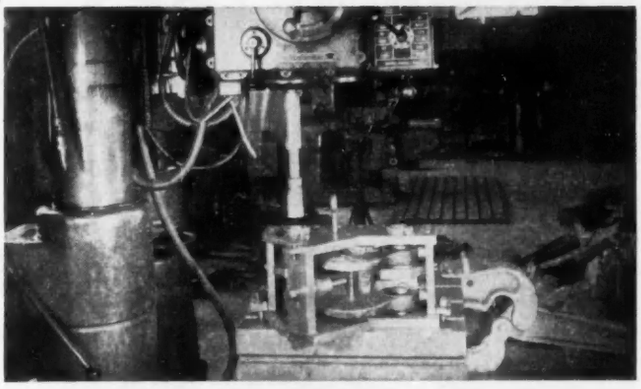

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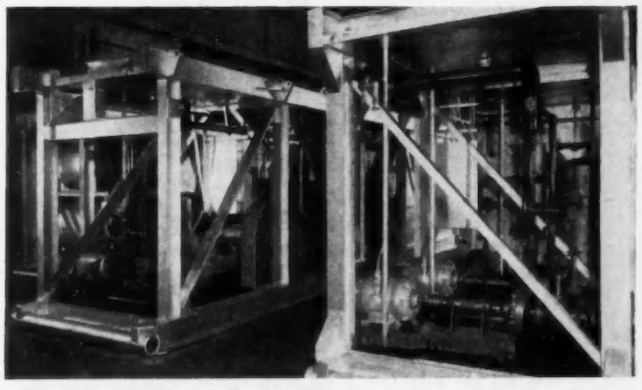

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Jameson-Strawn Sand Trend

Continued from Page 154

on an MER basis. Almost every well is still flowing.

The recurrent problem of mounting gas-oil ratios in producing wells will be greatly helped when Texas Natural Gasoline Corporation of Tulsa completes the construction of its 60 million cubic feet per day plant now under construction in the central part of the field, five miles southwest of Silver and two miles west of the Colorado River. Estimated output will be thirty cars of LPG products daily, with residue gas available for return to the reservoir.

The matter of recovery is of critical importance, and will undoubtedly determine the ultimate economic success of some of the producers with thin sand sections. A great amount of core information has been gathered, and the general conclusion is that primary recoveries per acre-foot will be low, and probably less than one hundred barrels. Some operators use figures substantially below this, so that the Spraberry analogy once more comes to mind.

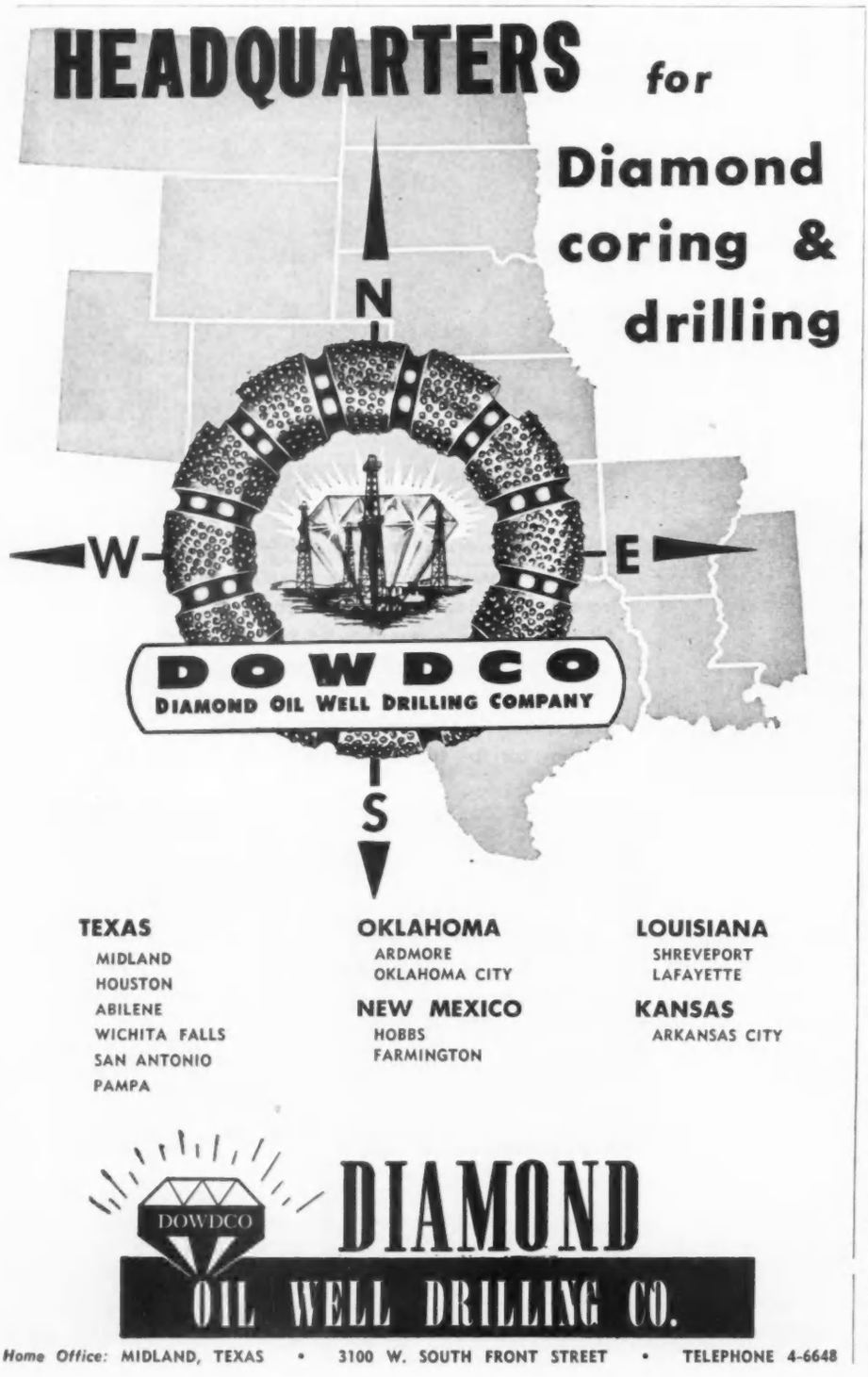
The number of feet of net effective pay requires determination for each individual well, as the sands sometimes come and go with much variation between offsets. The conventional electric microlog or contact log does not always reflect full details of permeability in these tight sands, and thickness of effective pay must be calculated on a statistical basis which may be more or less arbitrary. Natural fracturing presumably is a factor, and artificial rupturing adds not only to the initial recovery rate, but complicates the estimation of ultimate recovery.

It appears indisputable that the Jameson Strawn trend could only have been developed under the present economic and technologic conditions, with $2.90 crude and high-pressure, high-volume, formation fracturing to provide enough oil to pay for a well.

With the lessons of Spraberry vividly in mind, many operators have adopted a conservative attitude toward Jameson Strawn trend reserves. Time will tell what the profit margin will be for the producers responsible for this remarkable development program. Drilling contractors are operating on a highly competitive basis, in an area where costs are not low. Supply houses, service companies, and dirt contractors, however, should have reason to consider the Jameson Strawn trend a major industrial asset. And regardless of how the operators make out, the royalty owners are astride a magnificent source of revenue under tens of thousands of acres.

Within the next few years the productive limits of the present Jameson Strawn trend will probably be determined. When the final returns are in, the Jameson Strawn sand area undoubtedly will take its place as one of the nation's outstanding oil reserves. Provided, of course, that the nation believes in its domestic industry enough to protect the present market level.

—**The End**



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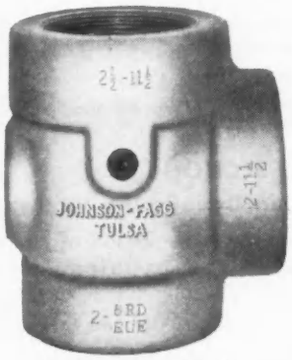

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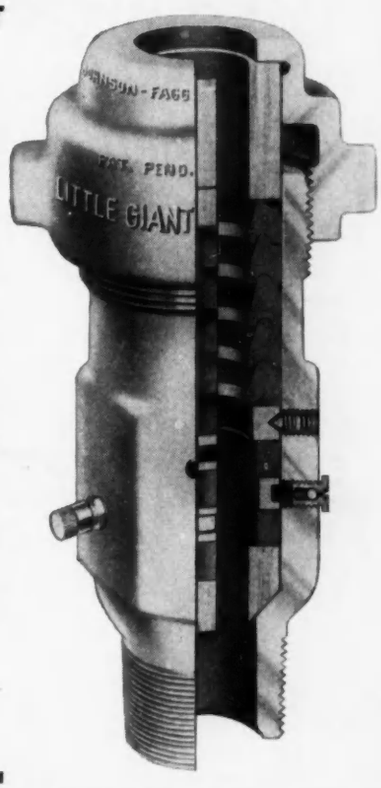

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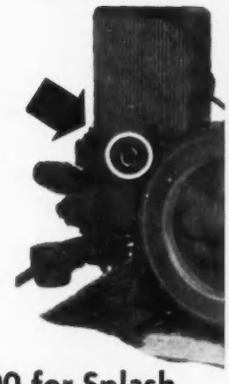

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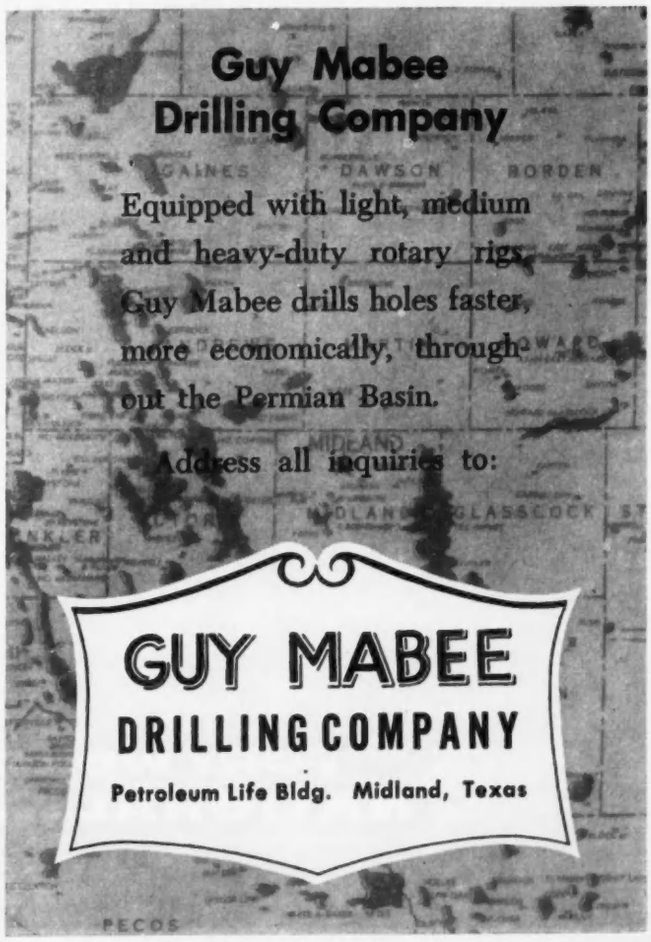

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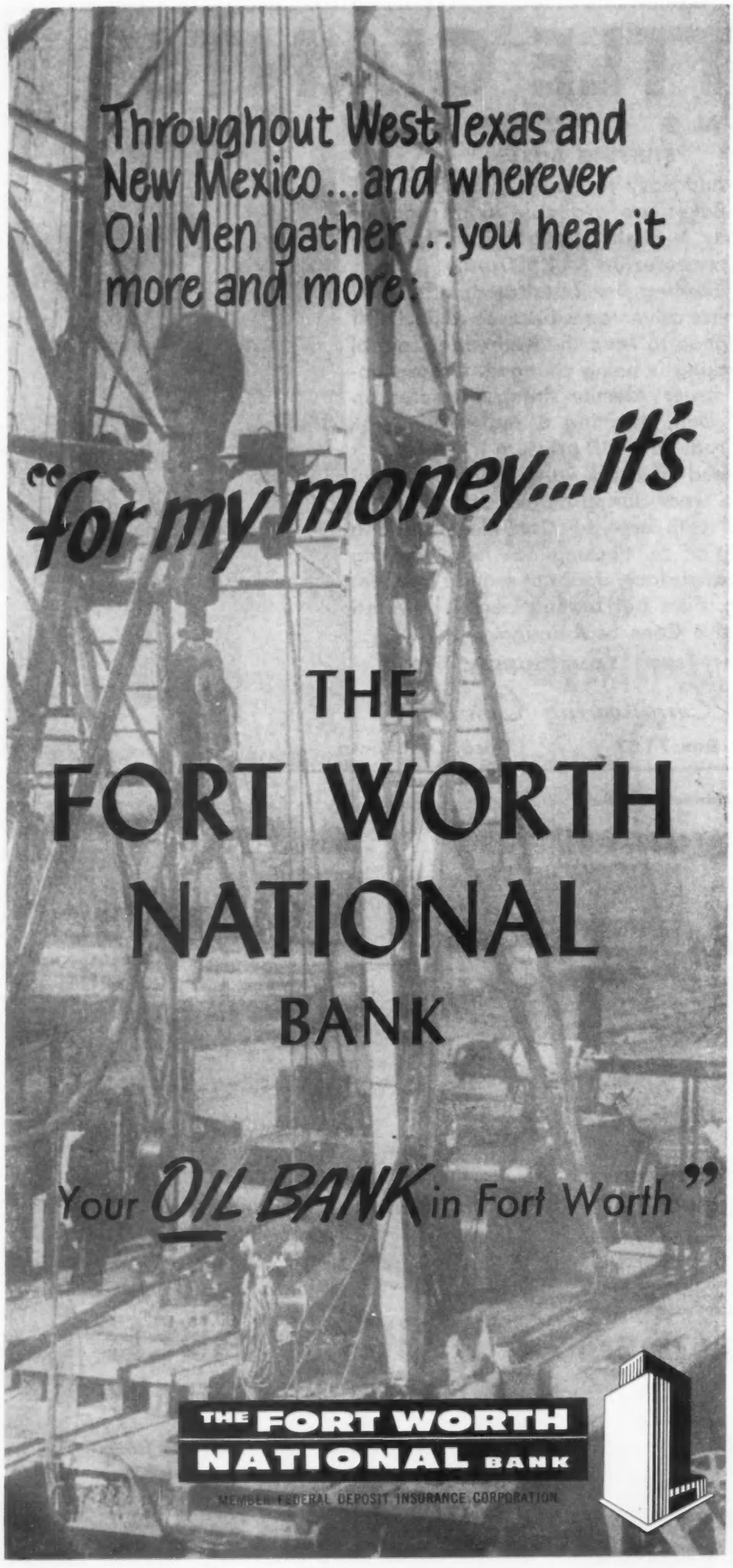
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Mineral Studies Outline West Texas Structures

This new exploration technique is proving successful in solving structural problems associated with formations in West Texas.

By Barnard H. Lasky

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An up-to-date discussion of current practices and problems in air drilling.

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Comparing Artificial Lift Methods for Deep Horizons

In deep wells, lifting is the big expense item. Here's how it is done in the Permian Basin.

By C. D. Borland, Jr.

Mineral Studies Outline West Texas Structures

- Studies of surface minerals reflect subsurface structures of Rawlings field in Coke County and Todd Deep field of Crockett County.

- Technique offers promise of disclosing structures in other areas of similar conditions.

- The method is based on the theory that minerals near surface have been altered above structural highs, due to higher temperatures.

By **BERNARD H. LASKY,** Consulting Geologist, Houston

THE ALTERATION study method for mapping subsurface structure is based upon the relationship of surface mineralization to the subsurface. The technique has been described by the writer, (1950 and 1953) and the relationships have been established for a broad range of individual case studies, both experimental and operational, in Texas, Louisiana, Mississippi, Kansas, Oklahoma, Colorado, Nebraska and Michigan.[4, 5]

Alteration studies were made recently of the Rawlings field, Coke County, and the Todd Deep field, Crockett County, Texas, areas which present two important problems in exploration.

Rawlings involves the delineation of Pre-Pennsylvanian highs, either structural or topographic or a combination of the two, on the Eastern Platform. Todd Deep is perhaps broader in its scope, for it concerns the mapping of the subsurface of the Ozona Platform in the southern part of the Midland Basin and of the Edwards Plateau, areas overlain by the Edwards limestone and associated beds of the Cretaceous which have presented major difficulties to exploration.

The importance of each of these case studies is two fold. It derives from (a) the conditions under which the study was performed and (b) the results of the study. Both studies were made on a 'blind' basis, i.e., the respective areas under consideration were not disclosed to the writer until the studies had been completed and reported upon. In addition no areal geological information and no subsurface data of any kind was revealed. Under these circumstances, it should be understood that the basic requirements for the successful application of the alteration study method remained unfulfilled.

Alteration study of Rawlings field. The Rawlings field is located in the H & T C RR Survey, Block 1-A, Sections 390 and 397, Coke County, Texas.

The structure consists of an asymmetrical anticline, faulted on the east, which strikes north and south. It has yielded production from Strawn limestone, Canyon limestone, Palo Pinto limestone, Goen limestone and Cambrian dolomite. The field has been described by Hayes, Donegan, Vinklarek and Beauclair (1954).[2]

The alteration study of the Rawlings field was initiated as an experimental project in 1953. It involved a total of 43 surface samples. In addition to the conditions referred to above, under which the study was performed, no sample plat was furnished the writer so that the locations of the samples with reference to each other were unrevealed. As these samples included a number of blind or undisclosed duplicates and triplicates, the effective number of samples available for the subsurface control for the problem accordingly was reduced to 37.

These samples were analyzed, using the laboratory procedures utilized for the method and the basic or so-called 'raw' values of the alteration data were then reported. As no sample plat had been submitted, no interpretation of the subsurface structure was possible as the sample locations were unknown.

Following this first report of alteration values, a sample plat showing the control grid which had been used in the sampling, was then furnished the writer without any disclosure, however, of the location of the area in which the samples had been taken. The sample plat indicated that three sample profiles had been taken across the area in an east-west direction, approximately 3500 feet apart. The samples along the profiles were spaced at intervals of about 700 feet. Several additional samples had been taken between the profiles. The locations of two dry holes and one producing well were revealed and the elevations of significant formations from each well were indicated.

The sample plan showed that three sections were included in the area of the study. There was a distance of 2600 feet between the three wells submitted for the calibration of the

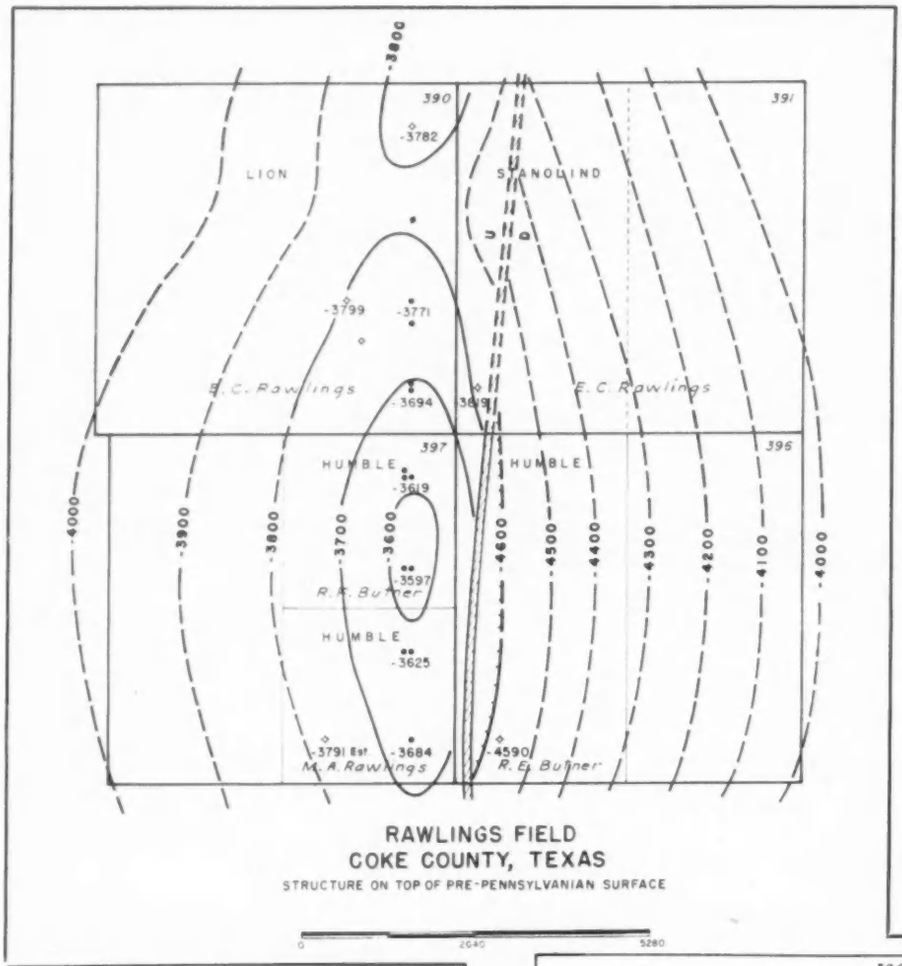

FIGURE 1 (Above)—Subsurface structure of the Rawlings field, Coke County, Texas, contoured on the Pre-Pennsylvanian surface—from Hayes, Donegan, Vinklarek and Beauclair, "Rawlings Field, Coke County, Texas," Cambrian Field Trip, Llano Area, San Angelo Geological Society, 1954.

alteration data with a known subsurface condition. This afforded a limited amount of control for the study and fulfilled one of the requirements for the interpretation.

A structural interpretation based on this data was then made. It indicated that a narrow anticline was present in the area and that the structure attained its maximum structural elevation in the south-central portion of the area. From this point, the strike of the anticline was almost due north for a distance of about one mile. The axis of the structure then appeared to swing to the northeast.

This change in strike was based on the interpretation of a single sample, the location of which did not offer an opportunity for confirmation or support by other samples. Based on the assumption that this sample might be erratic to this local area, the recommendation was made that supplemental samples be taken to afford additional control for this locality. A total of 24 samples was then taken. These included the check samples mentioned above and additional samples in other areas.

A second structural interpretation was then made and submitted. This interpretation supported the original interpretation and indicated that a narrow anticline or faulted ridge traversed the area in almost a north-south direction. Evidence of faulting on the east flank of the structure was noted and it was reported that the entire east half of the area was structurally low on the downthrown side of the fault and that this area was synclinal.

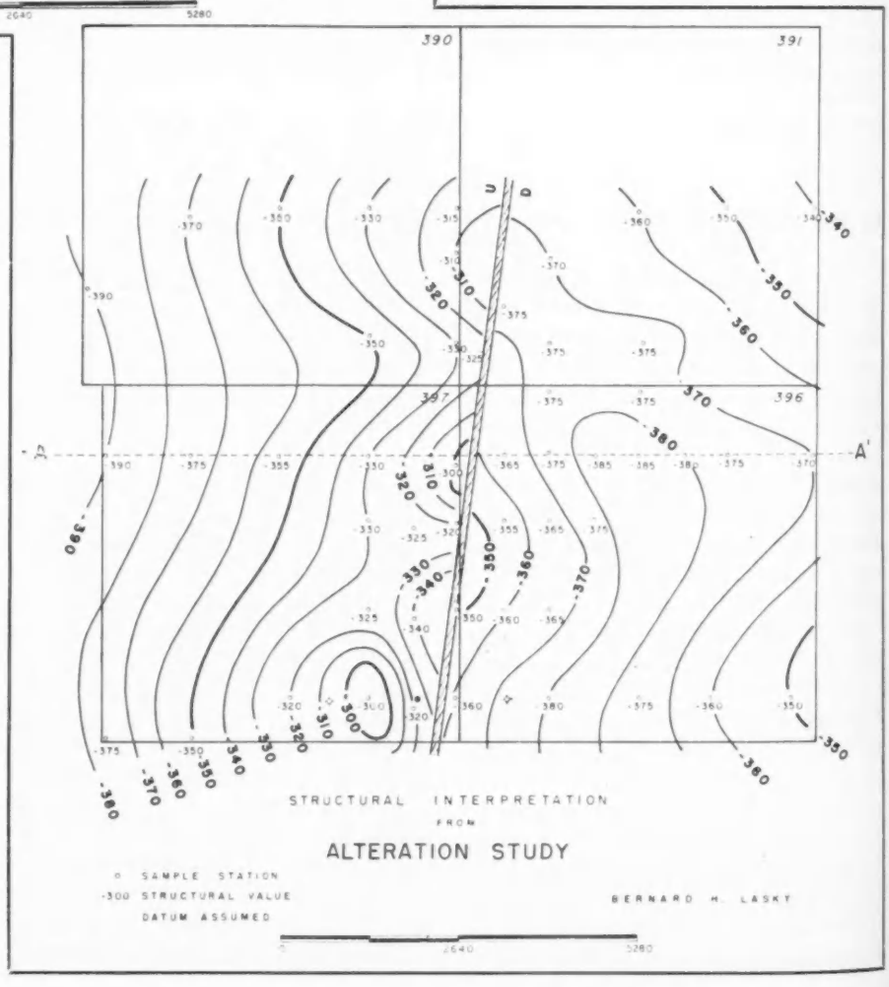

FIGURE 2 (Below)—Interpretation of the subsurface structure of the Rawlings field, Coke County, Texas, from blind alteration study.

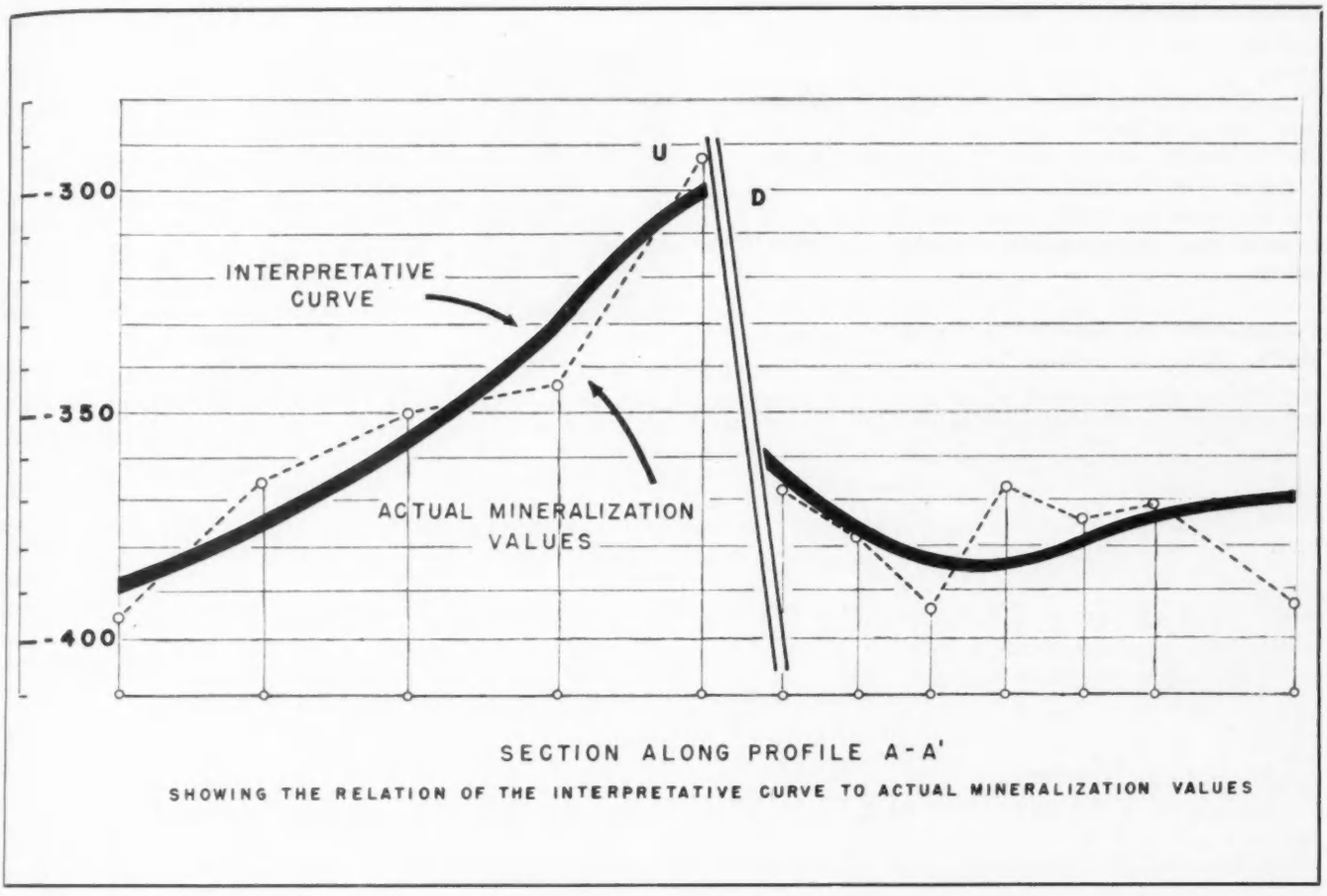

FIGURE 3—Section along sample Profile A-A', Rawling field, indicating the relationship between raw mineralization values derived from the analyses and the interpretative curve used to express the subsurface structure.

The additional samples which were taken to check the anomalously high sample to which reference has been made, failed to confirm its original reported value and indicated that this sample was not normal to the area in which it was located. As a result, the apparent change in the strike of the anticline from north-south to northeast-southwest was eliminated and an uninterrupted north-south strike for the structure was shown on the second interpretation.

Approximately three months after this interpretation was submitted, it was disclosed to the writer that the study had covered the area of the Rawlings field, Coke County, Texas. The opportunity was then afforded to compare the results of the blind study with the actual subsurface structure of the field.

Figure 1 shows the subsurface structure of the Rawlings field, contoured on the Pre-Pennsylvanian surface from Hayes, Donegan, Vinklarek and Beauclair (1954).[2]

Figure 2 shows the interpretation of the subsurface structure at Rawlings from the blind alteration study.

The interpretation indicates that a narrow anticline, faulted on the east flank, is present in the area. It shows three local highs on the structure, separated by saddles. The entire east half of the area is on the downthrown side of the fault and is synclinal.

The interpretation very closely approximates the actual subsurface structure of the field. There are two areas of minor difference: (a) The interpretation shows three local highs, separated by saddles, along the crest of the anticline. The structure of the field, as indicated by Figure 1, indicates one area of closure. (b) The interpretation shows east dip east of the fault into a syncline. The actual structure as shown in Figure 1, indicates continuous west dip over the downthrown area.

As far as (a) is concerned, it is probable that the difference can be attributed to the less than ideal conditions under which the study was made, together with the lack of experience in the interpretation of the data of alteration in this general area. It is considered, however, that a continuous north-south sample profile along the crest of the anticline might have resolved the difference. In connection with (b), Ayres (1954) indicates that closure is present against the fault[1] on the downthrown side and that east dip exists into a regional syncline, as it is shown by the alteration study in Figure 2.

Subsequent to the disclosure that the study had covered the Rawlings field, the entire project was re-examined in the light of all of the available information and a final interpretation was made. This interpretation is not reproduced here, for the modifications which were made in the interpretation shown in Figure 2 are not considered to be of importance. The final interpretation, however, shifted the high in the southeast corner of Section 397 slightly to the east, eliminating the east dip into the fault, as shown in Figure 2 and closing the structure against the fault at this point. It also reduced the intensity of the saddle between this high area and the one to the northeast in the northeast corner of the same section.

Figure 3 shows a section along Sample Profile A-A' and indicates the re-

lationship between the actual mineralization values derived from the analyses and the interpretative curve. It can be observed that the so-called 'raw' values of the alteration data offer the fundamental control for the problem of the interpretation and that the interpretative curve is essentially a smoothing curve applied to these values.

Comments on Rawlings field study. There are several basic factors which must be considered in the utilization of the alteration study method in order to insure optimum results. These are (1) an understanding of the regional structural features present in the geologic province in which the study is made; (2) the adaptation of the sample pattern or grid to the type of structural problem which is anticipated and (3) the calibration of the alteration data with an actual subsurface condition in the general area, in order to evaluate the several mineral parameters which are used as a matter of standard practice, for the area under consideration.

Items (2) and (3) are of particular importance. For example, in the Rawlings field, steep dips are encountered and the fault has a displacement of approximately 900 feet. It can be understood that the mapping of these features necessitates close spacing of samples. The physical and chemical character of the surface beds are factors involved in (3). If these beds have a marked degree of uniformity, the interpretation of the data of alteration is simplified. If, however, the surface formations exhibit an absence of homogeneity, such as the Permian surface at Rawlings, the standard procedure which involves a type calibration of the alteration data and a known subsurface condition, becomes important, in order that purely local and superficial effects which are due entirely to the inherent differences in the beds from sample station to sample station, can be recognized and eliminated.

These conditions are not fulfilled collectively or individually in the blind study. Such a study, therefore can only be considered as an experiment designed to determine if certain mineralization data derived from the sampling of the surface beds of an area, are in any degree related to the underlying subsurface structure. And while it is a fact that certain blind alteration studies have actually approached the accuracy of open detailed surveys in their results, it is illogical to anticipate that such an objective can always be attained.

The alteration study at Rawlings appears to indicate that Pre-Pennsylvanian highs in West Texas can be isolated by regional profiling and that the delineation of such features should result from detailed sampling combined with some experience with the controlling conditions of the general area.

Alteration study of Todd Deep field. The Todd Deep field is located in the southern portion of the Midland Basin, 18 miles northwest of Ozona, on the Ozona Platform.

The structure at Todd Deep is an asymmetrical anticline which strikes slightly west of north. The west flank of the structure is moderately steep and the dip along the east flank is extremely abrupt. An east-west cross fault with the downthrow on the north, cuts the structure on the north and the east flank shows evidence of thrust faulting. The structure has been fully described by Imbt and McCollum (1950).[3]

The alteration study at Todd Deep was designed as an experimental study of an undisclosed area. It involved two separate and independent studies, made at different times. It was not revealed to the writer that these projects were in any manner related. For the purposes of this report, the two studies will be regarded as a single project.

A total of 29 samples was submitted originally to the writer together with a sample plat indicating the locations of the samples with reference to each other. These samples consisted of 17 samples along a continuous north-south profile and 12 samples along an east-west profile which crossed the former at approximately its midpoint. The samples were spaced approximately 700 feet apart along the profiles.

The second set of samples was submitted about 60 days after the first set had been reported upon. A sample plat was furnished. This set involved 17 samples along a north-south profile and 15 samples along an east-west profile, the east-west profile crossing the former at its midpoint. The samples were spaced approximately 700 feet apart.

The samples of both sets consisted of gray limestone and what appeared to be gray and brown limestone residual soils. No information was revealed regarding the location of the general area under consideration, its areal geology, the regional or local structural characteristics of the area or the conditions under which the samples were taken in the field.

From a superficial examination of the samples, it was assumed that they were chip samples obtained from the outcrop of fresh unweathered limestone together with associated limestone residual soils.

Attention has been directed to the fact that the effective application of the alteration study method depends upon the calibration of the several mineralization parameters used in the study with a known subsurface condition for the geological province in which the study is located and that this calibration is required for the proper evaluation of the mineral parameters for that region. Having established the relationship for the prov-

About the Author

BERNARD H. LASKY has been a consulting geologist in Houston since 1935. For several years he has devoted his efforts particularly to the new technique of correlating alterations in surface minerals with indicated subsurface structural conditions. A graduate of Stanford University, with B.S. in geology and mining, he worked as a mining geologist before entering the oil industry as a geologist for Empire Gas & Fuel Company in Kansas and Oklahoma. He was subsequently a consulting geologist in Tulsa before moving to Houston.

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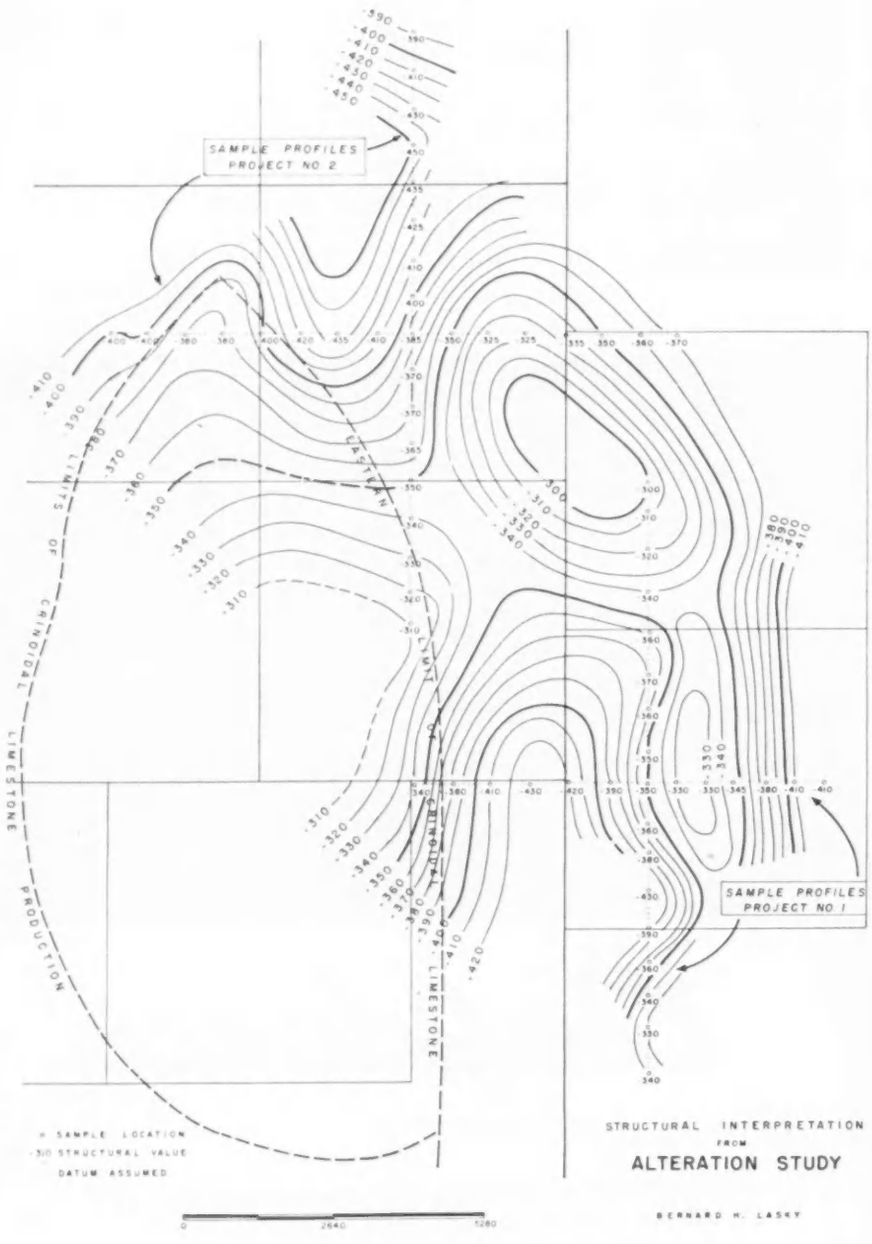

FIGURE 4—Interpretation of subsurface structure of the Todd Deep field, Crockett County, Texas, from blind alteration study.

ince, it is not generally necessary to repeat the calibration for a second area in the region as experience has indicated that no changes in the basic conditions are to be anticipated.

In addition, the calibration is necessary in order to establish the character of the mineralization, for in certain provinces the mineralization is maximum and in others it is minimum. These criteria must be established, as it is readily understood, before the results of the study can be directly related to the subsurface in any region.

It was recognized by the writer that the limestone samples submitted for this project represented an area in which no previous studies had been made. It was also understood that the area might possibly be one that was not susceptible to the alteration study method for the reason that previous experience had been confined to areas of unconsolidated sediments and although these sediments had included a wide diversity of soils such as heterogeneous sands, clays, marls, loess and glacial debris, no hard-rock areas had been studied.

The first set of samples, which is designated as Project 1 for the purpose of identifying it on the accompanying maps, was analyzed by the laboratory methods which previously had been utilized for unconsolidated material, although it was recognized that if hard-rock samples were to be worked successfully, some changes in laboratory procedures would undoubtedly be required. The alteration values for the samples were then reported and a map, contoured on these values was submitted.

With due consideration given to the several important unknown factors which were involved in the experimental study, the report which accompanied the map stated: "It is to be emphasized that the map is a mineralization map and that it may or may not have some relation to the subsurface structure. The mineralization values reported for this area may be a function of the local chemical changes in the limestone itself, in which event, the values would have no relation to the subsurface structure. However, if these values do have a relation to the subsurface . . . the high values may represent a high structural feature or a reef build-up. On the other hand, it is also possible that the low mineralization values may represent high structure and the high values, low structure."

Without directing attention to the results of Project 1 at this point, Project 2 will be described.

Project 2 was reported upon approximately six weeks after the report on Project 1 had been submitted. The report on Project 2 included the following observation: "The same unknown factors which were imposed on Project 1 are present" and "that the results of the study are subject to the same explanations and interpretations which were incorporated in the report on Project 1."

Four months after the completion of Project 2, it was revealed to the writer that the samples on both projects had been taken in the area of the Todd Deep field and the actual locations of the samples were disclosed. It then became apparent that the samples had been taken from the Fredericksburg limestone of the Cretaceous, which comprises the surface beds of the area.

The mineralization data, as pre-

viously reported, was then studied in the light of this disclosure. It was evident that the values reported for Project 1 indicated some relationship to the actual subsurface of that portion of the Todd Deep field which they represented, but that the values reported on Project 2 were not at all reconcilable with the subsurface of their local area.

It immediately became obvious, however, that the alteration values for both projects and which had been reported on a maxima basis, were actually minima quantities and that contoured on a minima rather than on a maxima basis, they were in close agreement with the subsurface conditions of the Todd Deep area.

Figure 4 shows the actual values reported originally on Projects 1 and 2, with these values contoured as minama instead of maxima quantities. No changes have been made in any of the numerical quantities indicated in the original reports.

Figure 4 shows the presence of an asymmetrical anticline in the area, which strikes northwest and southeast, on which there are two local closures separated by a saddle. The higher of the two closures is shown at the northern limit of the north-south profile of Project 1 and in the south-east quadrant of the sample profiles for Project 2. A syncline is indicated a half mile west of the axis of the structure and a second structurally favorable area occurs west of this syncline. Although no samples are available, it is evident that the maximum structural elevation on this structure would undoubtedly exist in the area immediately west of the south terminal point of the north-south profile of Project 2 and west of the west terminal point of the east-west profile of Project 1.

The subsurface structure of the Todd Deep field is shown in Figure 5. This is a composite structure map on which the structure on top of the Ellenburger is shown for the area east of the eastern limit of the Crinoidal limestone and the structure on top of the Crinoidal limestone is shown for the area west of the eastern limit of the Crinoidal limestone.

A comparison of Figures 4 and 5 indicates that there is a definite parallelism between the results of the alteration study and the structure of Todd Deep. The structure on the

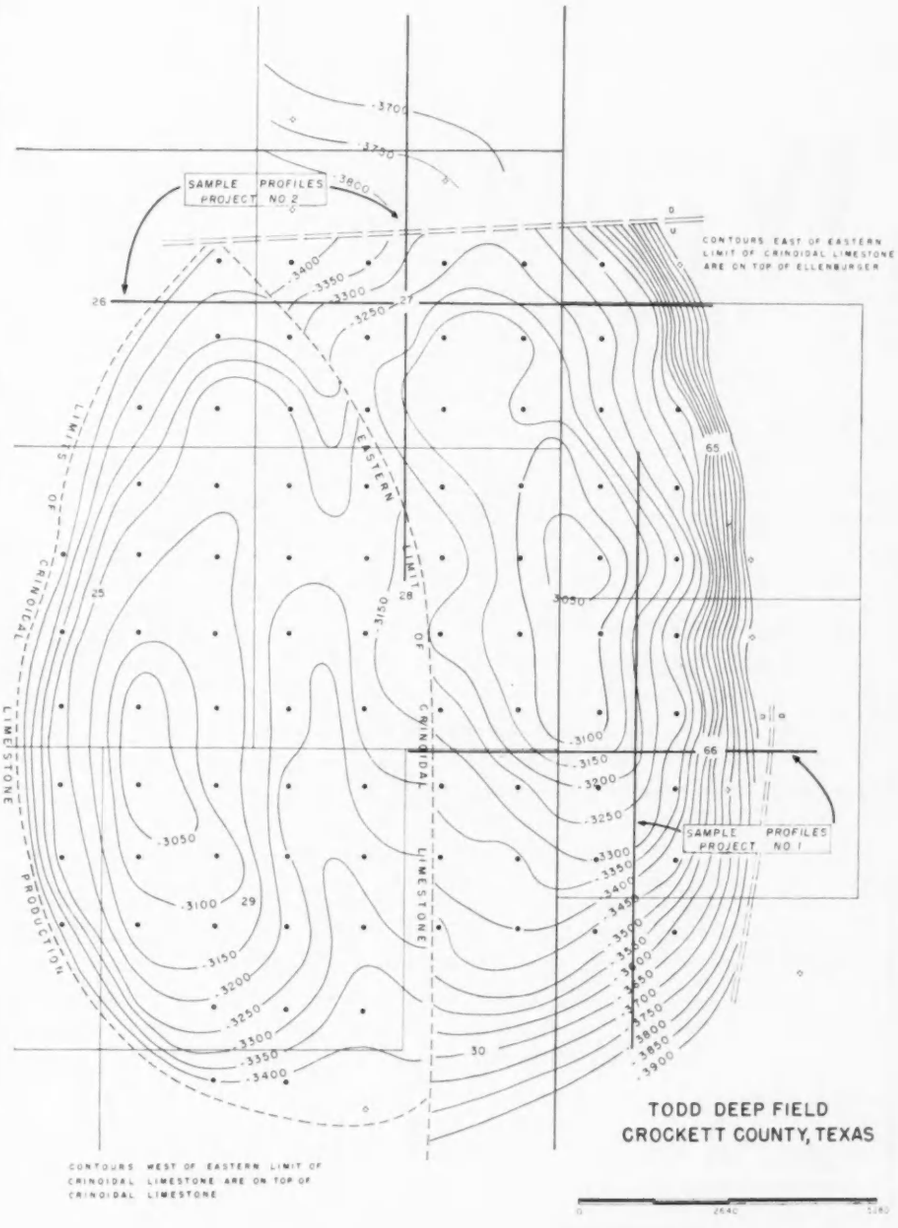
SAMPLE PROFILES PROJECT NO 2
SAMPLE PROFILES PROJECT NO 1
CONTOURS EAST OF EASTERN LIMIT OF CRINOIDAL LIMESTONE ARE ON TOP OF ELLENBURGER
CONTOURS WEST OF EASTERN LIMIT OF CRINOIDAL LIMESTONE ARE ON TOP OF CRINOIDAL LIMESTONE
EASTERN LIMITS OF CRINOIDAL LIMESTONE
CRINOIDAL LIMESTONE PRODUCTION
TODD DEEP FIELD
CROCKETT COUNTY, TEXAS

FIGURE 5—Subsurface structure of the Todd Deep field, Crockett County, Texas. Structure on top of the Ellenburger is shown for the area east of the eastern limit of the Crinoidal limestone and structure on top of the Crinoidal limestone is shown for the area west of the eastern limit of the Crinoidal limestone—from Imbt and McCollum, "Todd Deep Field, Crockett County, Texas," Bull. Amer. Assoc. Petrol. Geol., Vol. 34, No. 2 (Feb. 1950).

Ellenburger has been semi-quantitatively indicated by the study. The syncline west of the Ellenburger structural axis, shown in Figure 4, represents the effect on mineralization of the eastern limit of the Crinoidal limestone. The north and east dips west of the syncline, as indicated by the study, are an expression of the increasing thickness of the Crinoidal limestone in this area. The maximum thickness of the Crinoidal limestone as shown in Figure 5, is attained in the area in which the structural effect of the reef on mineralization has been projected, as indicated in Figure 4.

Reference to the sampling patterns for Projects 1 and 2, will result in the

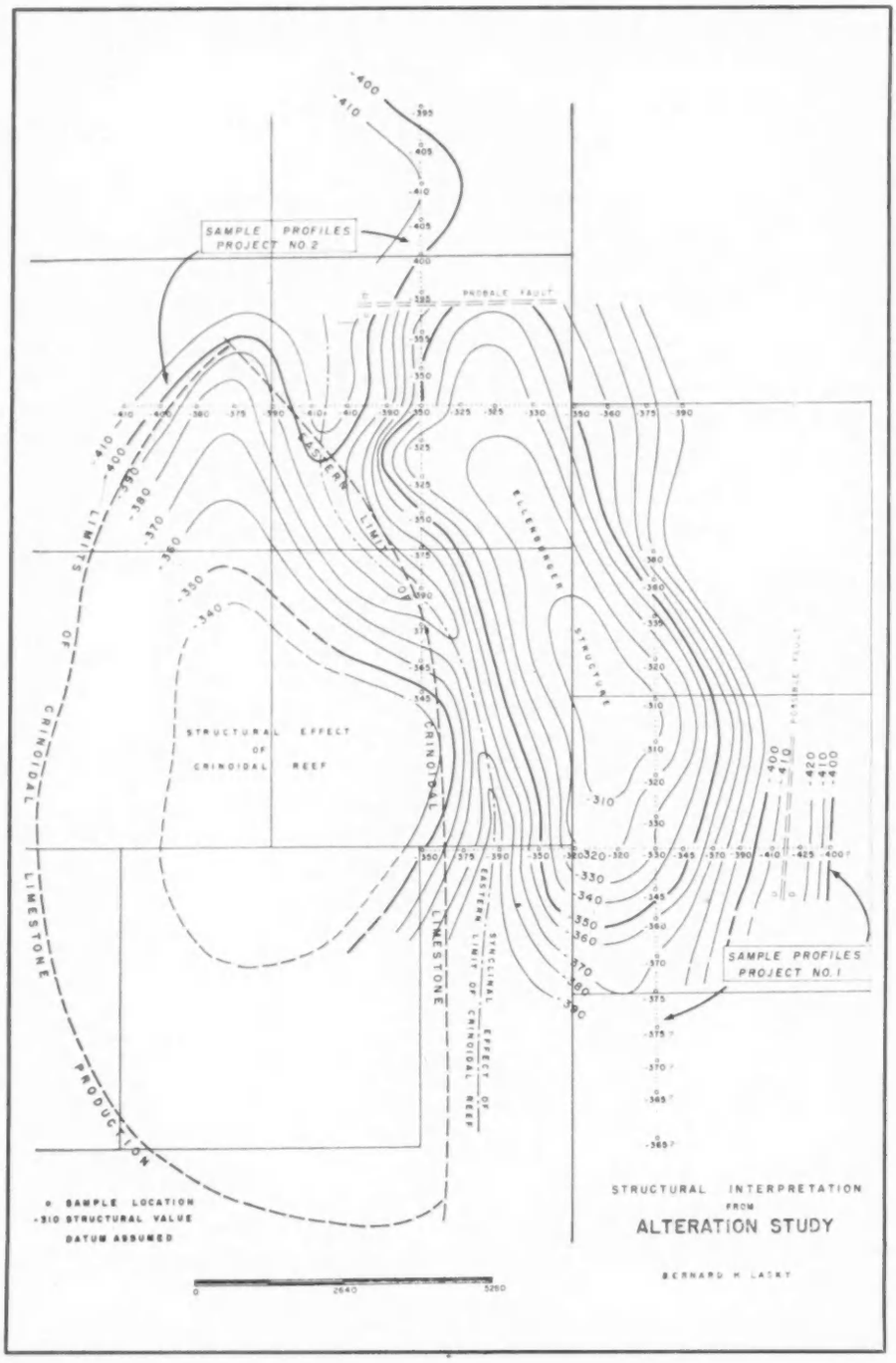

FIGURE 6—Final interpretation of the subsurface structure of the Todd Deep field from alteration study. Based on original mineralization data and made following the disclosure of the location of the studied area.

observation that these patterns are superficial and inadequate considering the extent and the character of the subsurface conditions of the Todd Deep field. The limited amount of sample control which they afford individually, however, becomes more competent, at least to some extent, in the consideration of these projects as a unit, despite the fact that they are not connected by sample control.

The combined data were then studied, using the knowledge of all the geological factors associated with the area. This re-examination permitted the calibration of the mineral parameters with the subsurface, made possible an evaluation of these parameters and an interpretation of the structure based on some measure of basic information on the area. It should be understood, however, that two important adverse factors continue to be a severe handicap. These are: (a) the absence of the opportunity to secure some degree of uniformity in the actual taking of the samples in the field, and (b) the inadequate sample grid which provided the only control for the study.

The results of the final interpretation are incorporated in Figure 6. It can be observed that this interpretation does not incorporate any major changes over the blind interpretation of Figure 4. The most important change is represented by the interpretation of the structure of the Ellenburger and this indicates a closer parallelism with the actual structure as shown in Figure 5. The synclinal effect of the eastern limit of the Crinoidal limestone on the alteration data and the effect of the structure of the Crinoidal reef, remain essentially unchanged from the blind interpretation of Figure 4.

Comments on alteration study of Todd Deep field. The alteration study of Todd Deep assumes particular significance if the discovery history of the field is reviewed.

A surface structure was mapped in the area in 1925; shallow production was obtained in 1933, after several dry holes had been drilled; the first Ellenburger dry hole was drilled in 1933; a second Ellenburger test was a failure in 1940; Crinoidal limestone production was established in 1940; Ellenburger production was finally proven in 1944, some 19 years after the first efforts had been made to find production in the area.

The results of the blind alteration study of Todd Deep, although understandingly neutralized to some extent by the conditions under which the study was made, appear to offer promise in the solution of the structural problems associated with the Cretaceous areas of West Texas and suggest a new approach to the problems of other areas in which similiar conditions exist.

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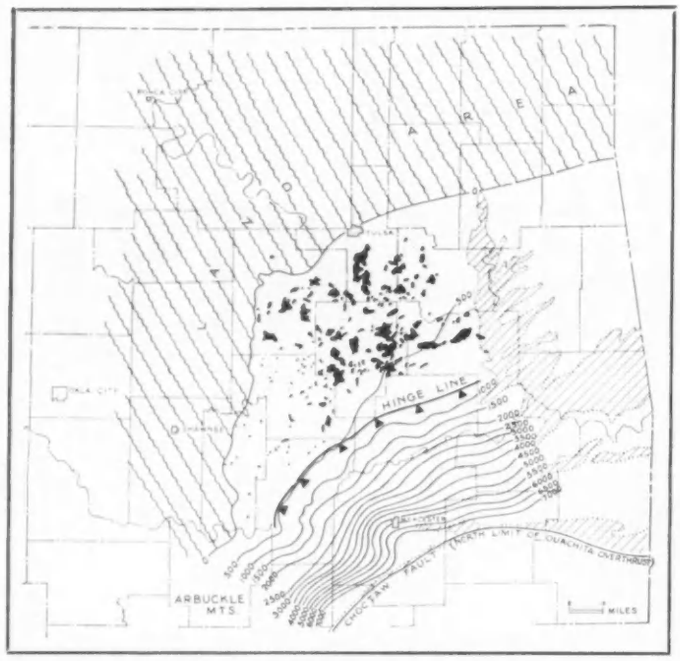

FIGURE 1—Map of Atoka unit. Parallel diagonal lines indicate outcrop on south and east. Isopach interval, 500 feet. Zero isopach is shoreline. Abrupt change in spacing of contours occurs at hinge line or shelf edge. Fields producing oil from Gilcrease and Dutcher sands are shown in black. These are obviously confined to shelf.

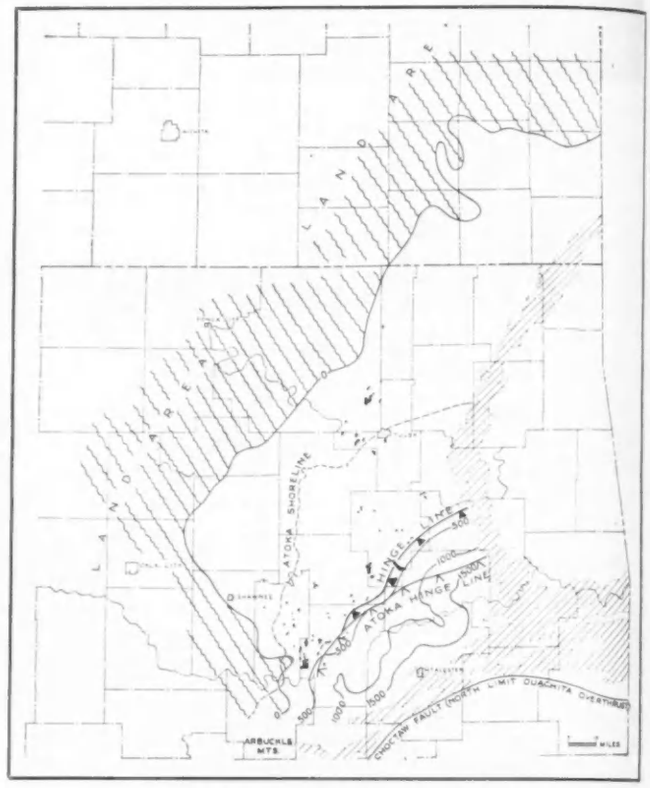

FIGURE 2 (Right)—Map of lower Cherokee unit. Symbols same as in Figure 1. Isopach interval, 500 feet. Position of Atoka shoreline and hinge line is shown. The lower Cherokee shoreline advanced west 25 miles and north 75 miles beyond Atoka shoreline. Hinge line moved 20 miles north but did not shift west because of uplift on Hunton arch. Oil fields producing from Booch sand are limited to shelf.

Regional Diagnosis of Oil Accumulation

Study indicates oil accumulation is restricted to a sedimentary shelf. Concept offers basis for judging regions where no tests have been drilled.

By T. E. WEIRICH, Phillips Petroleum Company, Bartlesville, Oklahoma

THE EXISTENCE in a region, remote from oil-producing areas, of oil or gas seeps, porous strata interstratified with black shales, "marine" beds, or carbonaceous material in the rocks at the surface is often cited as criteria favorable to commercial oil accumulation in the subsurface. Customary procedure of exploration is to locate anticlines and drill test wells on them.

However, vast oil-producing regions exist in North America that exhibit none of the enumerated criteria. Moreover, a greater total of oil has been produced from fields located on monoclinal than on anticlinal structure.

This article is intended to illustrate a regional geologic condition that reveals a principle of oil accumulation. Although based on the outcropping rock strata of eastern Oklahoma and eastern Kansas, the principle is applicable to other oil-producing provinces and strata. The principle is based on the proposition that oil has accumulated over a moving shelf in the region and rock section discussed in this article. The repeated occurrence of oil limited to the shelf validates such a conclusion. However, studies based on this conclusion, usually must embrace wide belts which have onlapped cratonal regions.

Here and there elongated, narrow sand bodies, isolated and enclosed by shale, exist in the Pennsylvanian beds of eastern Oklahoma and Kansas. These are suggestive of offshore barrier beaches deposited in a littoral (exposed at low-tide) environment. Other sand bodies are remote from the shore line, patchy or broad in outline. These may be classed as neritic (deposited in shallow water by wave action and marine currents at depths under low-tide) in origin.

The picture in eastern Oklahoma and Kansas during Pennsylvanian time from northwest to southeast in cross section is:

1. A low exposed plain of the craton.

2. A submerged shallow cratonal shelf of thin deposits containing shale-enclosed sandstones, diverging gently seaward.

3. A hinge line defining shelf deposition on the northwest and abruptly diverging basin sediments on the southeast.

4. A basin composed of a rock wedge diverging rapidly to the southeast.

5. A belt of structural complexity.

Oil accumulation. Accompanying maps present the relationship between the shelf as it existed during Pennsylvanian time and the sites of oil accumulation in eastern Oklahoma and eastern Kansas. The regional site of oil accumulation is limited to the shelf. Position of the shelf is mapped

at the end of four time intervals. Each of these intervals is a unit of strata, thickening gradually southeastward from the shoreline across to the edge of the shelf, which is the hinge line, then thickening abruptly into the McAlester basin.

Oil sands of Pennsylvanian age contained within these four wedges have produced more than 3¼ billion barrels of oil to January 1, 1953. New fields and secondary recovery practices may be expected to raise ultimate recovery to more than 4 billion barrels of oil.

Atoka Unit. Figure 1 is a map of the oldest unit considered here, the Atoka formation, which contains the Gilcrease and Dutcher sands in the subsurface.

The sandstones over the shelf area are patchy. They subdivide into vertical multiplicity, merge into one sand body, and perform such tricks of disappearing, reappearing, subdividing, and piling into thick masses as to baffle an experienced investigator.

In Creek County, Oklahoma, the Dutcher sand persists as one body over a relatively large area. Here the Bristow and Slick oil fields are updip stratigraphic traps along the eastern margin of a thick porous sand body, and the Depew field is an anticlinal accumulation in the same sand. Elsewhere on the shelf small isolated lenses produce oil. Outlines of fields are extremely irregular, elongate, or amoeboid in shape, according to the porosity of the reservoir rock. No trend pattern of all the fields is discernible. No sands continue far over the hinge line into the McAlester basin.

The Dutcher and Gilcrease sands are estimated to have produced 325 million barrels of oil to January 1, 1953.

The following general observations may be drawn from the conditions outlined.

1. An environment favoring irregular sand deposition prevailed over the shelf.

2. Accumulation of oil is limited to the shelf, bounded on the southeast by a hinge line, on the northwest by the shoreline.

Lower Cherokee Unit. Above the Atoka unit are the McAlester and Savanna formations. These are shales containing the Warner sandstone member. This grouping is here designated the lower Cherokee unit because all components are present, in abbreviated form, in the southern Kansas Cherokee section. Absence of the Hartshorne sandstone on the shelf results in a disconformable contact between the Atoka and the overlying McAlester formations. Map of the unit is shown in Figure 2. The hinge line has moved about 20 miles north of its Atoka position but did not shift west because of uplift of the Hunton arch, a geologic feature on the craton. The shoreline moved west 25 miles and north 75 miles.

The Warner persists as a sandstone on the surface throughout the McAlester basin but becomes irregular though recurrent along the outcropping shelf. From Muskogee, Okla., northward it is mapped as the Little Cabin sandstone. In subsurface the Warner is called the Booch, Taneha, Tucker, or Hogshooter sand. As on the surface outcrop, it is persistent in the McAlester basin and is irregularly distributed over the shelf area.

The Booch becomes a single, thin lenticular sand in the northern part of the shelf area, splits into three members in the southern part, and attains a thickness of 300 feet (comprising almost the entire lower Cherokee section) in the vicinity of Henryetta, Okla. About 60 percent of the oil produced from the Booch sand occurs in anticlines. Sand lenses in the shelf area, remote from the McAlester basin, contain commercial oil. Southeast limit of production is the lower Cherokee hinge line.

Oil production from the Booch is relatively low compared with that of other Pennsylvanian sands. Total production on January 1, 1953 is estimated at 51 million barrels.

The general observations noted for the Atoka unit apply equally well to the lower Cherokee.

Middle Cherokee Unit. The next succeeding unit is the Boggy shale of southeast Oklahoma, here designated the middle Cherokee unit. Lithologically it is shale containing two sands, the Bartlesville and Red Fork.

The middle Cherokee sea covered all of eastern Oklahoma and eastern Kansas, reducing the Nemaha anticline to a peninsula and its southern extension to an archipelago. Each of these islands was an active uplift, and each was a link in a north-south chain of anticlines across central Oklahoma. The hinge line advanced farther west, shifting about 25 miles from its lower Cherokee position. The shelf broadened to a width of 150 miles, advancing 40 miles west in Oklahoma and 75 miles west in Kansas.

Middle Cherokee time began with deposition of the Bartlesville sand. The contemporary areal geology, distribution of sand over the sea floor, position of the hinge line, and sites of oil accumulation are shown in Figure 3. This member of the Boggy formation is a persistent subsurface sandstone approximately 200 miles long, 50 miles wide, and 100 feet thick. Its outcrop correlative, the Bluejacket, is a thin, rubbly, lenticular sandstone. In wells downdip from the outcrop in northeastern Oklahoma, the sandstone is either absent or is less than 10 feet in thickness. Farther south it crops out as massive sandstone over much of the McAlester basin.

The Bartlesville sand was deposited in marine waters 30 miles east of the land area in a belt generally parallel with the shoreline. Paleogeology of the land area was mainly exposures of Ordovician, Silurian, Devonian, and Mississippian limestone. Pre-Cambrian granite was exposed over an area of about 1,000 square miles along the crest of the Nemaha anticline. Paleogeology of the land area, as now interpreted from well control, is shown in Figure 3.

Oil has accumulated in anticlines in the main body of the Bartlesville sand and in arcuate lobes along its eastern, updip margin. Separate lenses, east of the main sand body, have been prolific producers of oil in northeastern Oklahoma. Bartlesville oil is sparse in eastern Kansas; however, the sand has yielded gas over a wide area.

The Red Fork sand occurs both as long, narrow ribbons and as broader lenses. It is sometimes referred to as the "shoestring sand" of central Kansas and Oklahoma.

Northwest convergence of the middle Cherokee unit brings the Red Fork and Bartlesville sand so near together that identity is at places uncertain; some geologists call all middle Cherokee sands "Bartlesville." The Red Fork produces oil from anticlines and along its updip eastern margin in north-central Oklahoma. Total production of the middle Cherokee sands was 2.6 billion barrels of oil to January 1, 1953.

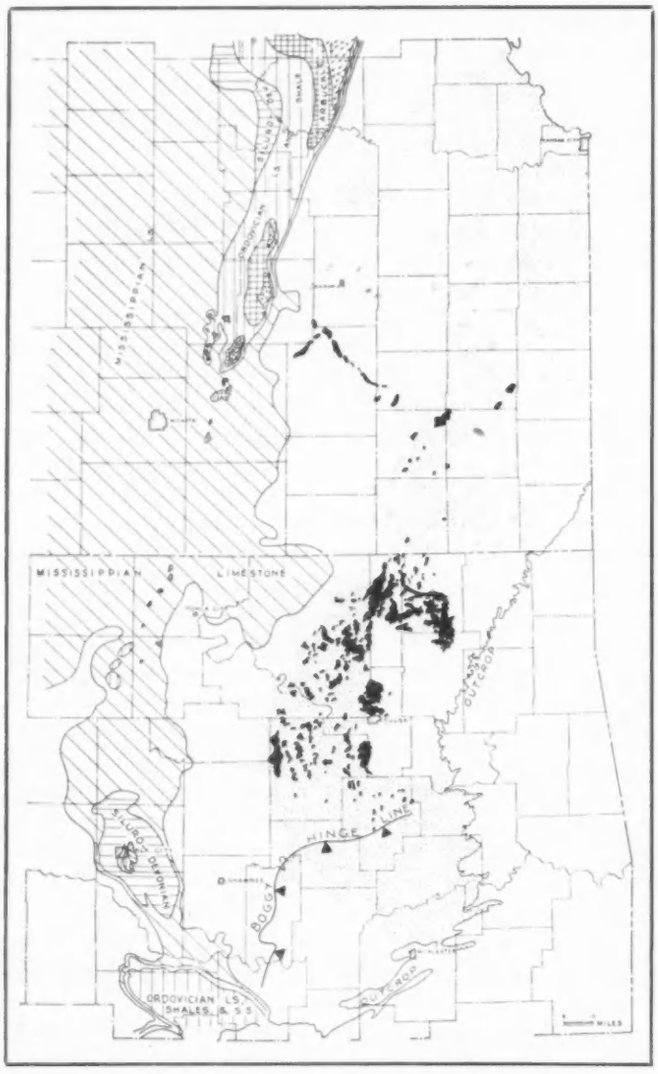

FIGURE 3—Map of Bartlesville sand. Symbols same as in Figure 1. Position of Boggy hinge line (which shale contains the Bartlesville sand) is shown. Oil fields are shown in black, non-producing sand by stippling. Sand contains no oil southeast of the Boggy (middle Cherokee) hinge line although ample anticline and well defined stratigraphic traps occur. Exposures of landmass on west were largely Paleozoic limestones in Bartlesville time. Pre-Cambrian granite indicated by checks.

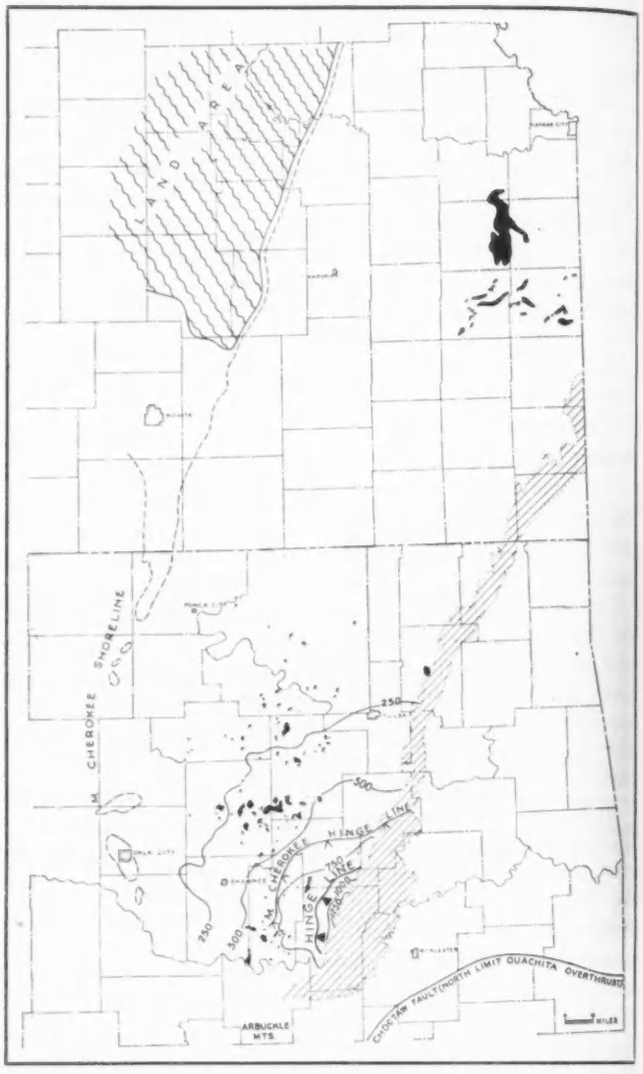

FIGURE 4—Map of upper Cherokee unit. Symbols same as in Figure 1. Isopach interval, 250 feet. Position of the middle Cherokee shoreline and hinge line is shown. Upper Cherokee sediments were deposited disconformably upon middle Cherokee rocks over shelf area. Upper Cherokee sea inundated Oklahoma and eastern Kansas, restricting land area to apex of Nemaha anticline in northern Kansas. Hinge line regressed 15 miles southeast and sands of unit (Prue, Senora, and Skinner) produce oil farther east than those of the underlying unit. Oil fields occur only over shelf.

The trend of the middle Cherokee hinge line is northeast-southwest (Figure 3). Numerous non-productive anticlines and stratigraphic traps are present in the persistent Bartlesville sand south of this line. It is apparent that oil never existed in the basin area, for anticlines there have ample relief, and stratigraphic traps are well defined. Accumulation is limited to the shelf area.

Upper Cherokee Unit. The Thurman, Stuart, Senora, and lower Calvin formations of east-central Oklahoma are grouped to form the upper Cherokee unit. Subsurface oil-producing rocks are referred to as the Thurman, Skinner or Senora, and Prue or Squirrel sands (Figure 4).

Boggy sediments were exposed to erosion over the shelf area during the earlier part of upper Cherokee time; Thurman and Stuart deposition was restricted to the McAlester basin and Senora sediments rest disconformably on Boggy over the shelf.

The invading Senora and Calvin sea covered all of the region except the north part of the Nemaha anticline, moving the shoreline far westward. The hinge line moved back to a position east of its site in middle Cherokee time. A shelf broadened both on west and east resulted.

Senora and Calvin sandstones over the shelf are lenticular and sparingly distributed; equivalent McAlester basin sands show continuity.

Oil fields producing from upper Cherokee sands are scattered over the shelf. Narrow shoestring fields produce from the Squirrel sand in east-central Kansas. Homoclinal structure prevails over most of the upper Cherokee oil fields.

The southeastern limit of upper Cherokee oil production is the hinge line. Total production of upper Cherokee sands is estimated at 230 million barrels of oil on January 1, 1953.

Only a small part of the unit remains in the McAlester basin, the hinge line being only ten miles west of the outcrop. Accumulation of oil is confined to the shelf area.

ACKNOWLEDGMENT

This article prepared for WORLD OIL and is based on a paper entitled "Shelf Principle of Oil Origin, Migration and Accumulation" published in *AAPG Bulletin*, Vol. 37, No. 8, pp. 2027-45, August, 1953.

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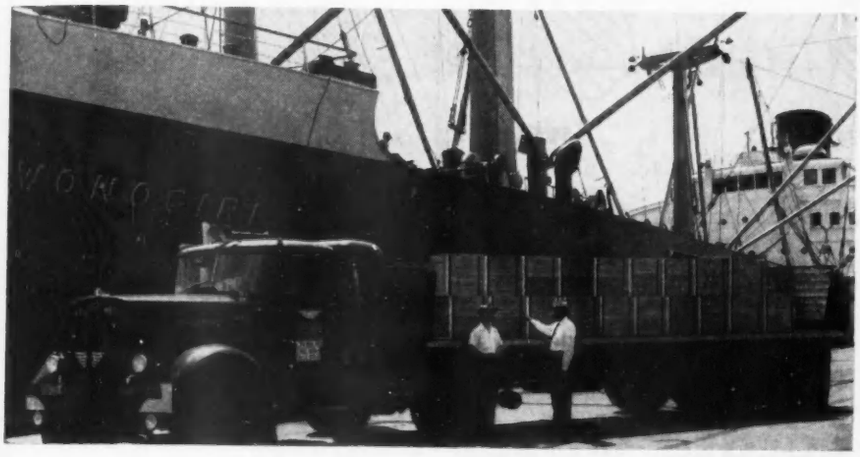

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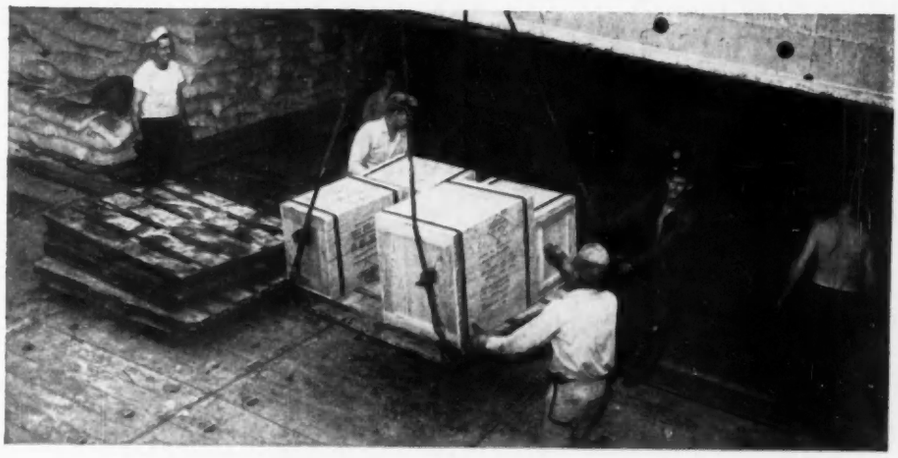

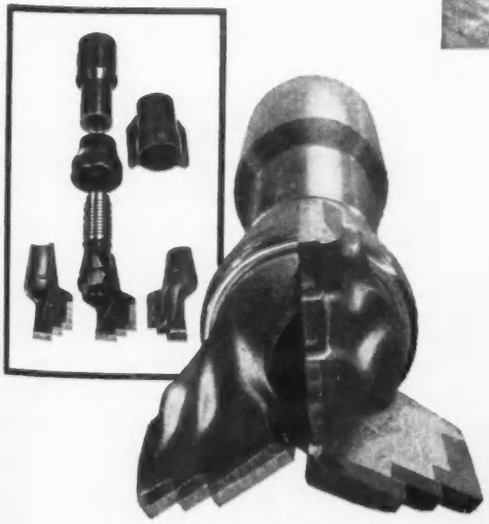

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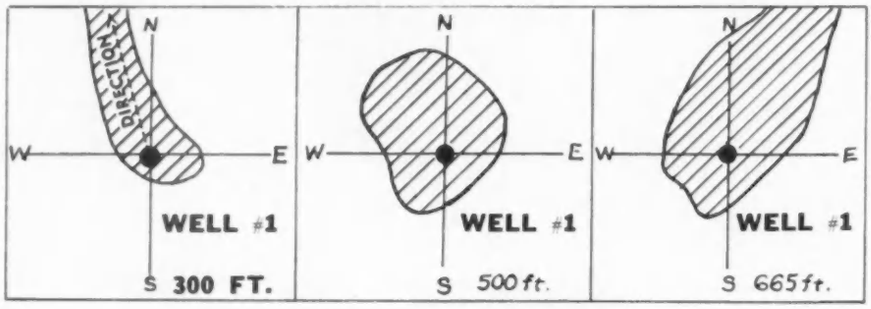

Figure 1—Conductivity charts from Well 1.

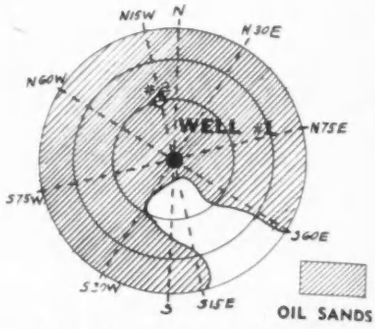

Figure 2—Sand pattern for Well 1.

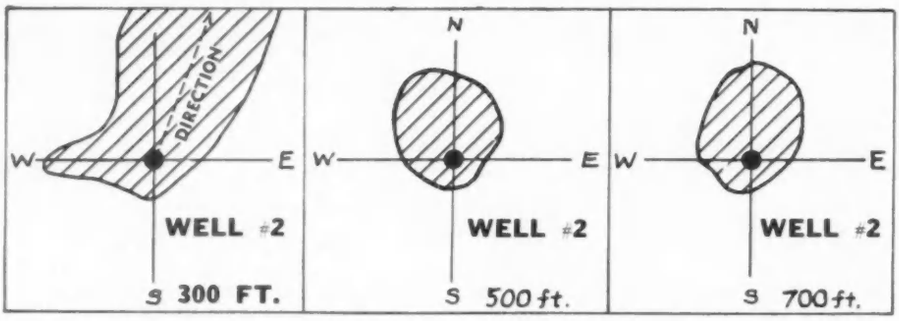

Figure 3—Conductivity charts from Well 2.

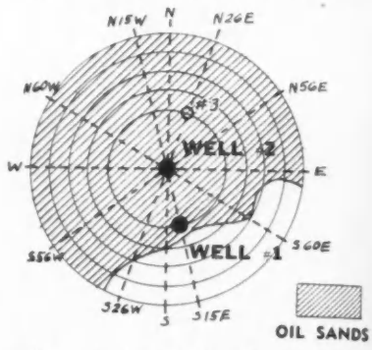

Figure 4—Sand pattern for Well 2.

A New Way to Locate Offset Wells

The electrical method shows the most favorable direction for stepping out to drill a well offsetting a discovery well. This new technique minimizes dry holes in developing an oil or gas field.

By ANTHONY GIBBON, World Oil Staff

A new technique has been designed for determining the most promising locations for additional wells offsetting a discovery well in developing an oil or gas field after its discovery.

After the discovery well is drilled into the producing sand, the drilling tools are removed from the hole, and an electrode is placed in the hole in contact with the producing sand. Surface electrodes are placed at varying distances and directions from the hole, and the appropriate currents and associated potentials are measured. From these measurements, conductivity charts and the sand pattern are constructed. Experience has shown that the most favorable direction for an offset well is indicated by the highest conductivity.

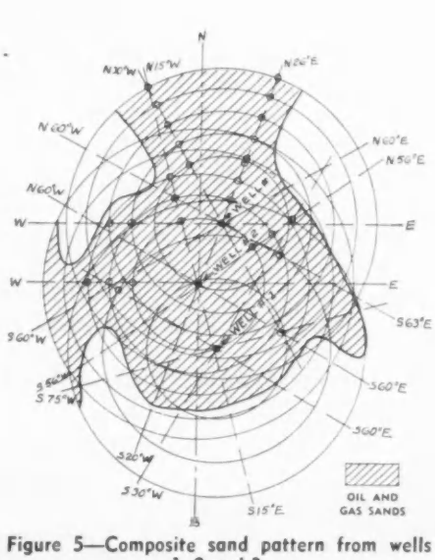

Figure 5—Composite sand pattern from wells 1, 2 and 3.

This new technique for minimizing dry holes in in-field drilling was developed by Dr. Frederick W. Lee, president of the Lee Geophysical Survey Company, Baltimore, Md.

Known as the Lee Sand Extension technique, it was developed in connection with drilling campaigns in Eastern Ohio and Western Pennsylvania, as a means of assuring orderly development of an oil or gas field after its discovery.

The following explanation and de-

scription show how the method works and how it was applied on a lease in Eastern Ohio.

The Bankes Lease of the Portersville Oil Company was under development. The first well was drilled a few feet into the producing sand, the Berea, at about 1350 feet. At this point, the drilling tools were removed from the hole and an electrode was placed in the hole in contact with the producing sand. Surface electrodes were placed at different distances and directions from the discovery well, and the appropriate currents and associated potentials were measured. From the measurements, conductivity charts and the sand pattern were constructed (as shown in Figures 1 and 2). These data pointed out the best location for an offset well, as experience has shown that the most favorable direction for an offset is indicated by the highest conductivity.

Since the spacing in this area is 300 feet and since at 300 feet from the well the highest conductivity was shown 15 degrees west of north, this location was selected for the second hole. The sand pattern showed a barren area to the south-southeast of the well, indicating that the location selected was well within the saturated sand.

After the survey was made, the No. 1 well was completed as an oil producer.

The second well was drilled, and when the pay sand was penetrated, a survey was made from it, in like manner to that in the first well. The conductivity charts and sand pattern from this second survey are shown in Figures 3 and 4. In this case the greatest conductivity at 300 feet from the well was north 15 degrees east, and therefore the third well was located at this point.

Again after the survey, No. 2 well was completed as an oil producer, and No. 3 well was drilled, and a third survey was made. No. 3 was also a producer.

Figure 5 is a composite sand pattern picture made from the results of the surveys from the three wells. A large number of favorable locations were established by the three surveys.

—The End

Geologists Study Cores in Texas U. Collection

About 150 oil company geologists made use of facilities in the Well Sample and Core Library of the University of Texas at Austin, during 1954, according to Philip S. Morey, geologist in charge.

The library is a part of the University's Bureau of Economic Geology, of which Dr. John T. Lonsdale is director. Formerly the samples and well cores were stored in several places on the campus of the Main University, but for several years they have been housed in once-spacious but now overcrowded quarters at the University's Balcones Research Center.

The library is one of the largest public collections of its kind in the United States. It includes facilities for the study of more than 4 million individual samples representing more than 55,000 oil, gas, and water wells in every section of the state.

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• Wildcat Drilling—In April and First Four Months 1955—1954

STATE or DISTRICT	MONTH OF APRIL, 1955						FIRST FOUR MONTHS, 1955-1954									
	New Fields			Total Discoveries	Dry Wildcats	Total Wildcat Tests	New Fields			Total Discoveries		Dry Wildcats		Total Wildcat Tests	
	Oil	Distillate	Gas				Oil	Distillate	Gas	4 Mo. 1955	4 Mo. 1954	4 Mo. 1955	4 Mo. 1954	4 Mo. 1955	4 Mo. 1954
Alabama	..	....	..	.....	7	7	..	....	..	..	..	27	21	27	21
Arizona	..	....	..	.....	....	....	..	....	..	..	..	4	2	4	2
Arkansas	1	....	..	1	9	10	4	....	..	4	1	39	30	43	31
California	2	....	..	2	22	24	7	....	..	7	9	88	110	95	119
Colorado	4	....	2	6	68	74	15	1	8	24	20	235	126	259	146
Florida	..	....	..	.....	....	....	..	....	..	..	1	11	9	11	10
Georgia	..	....	..	.....	....	....	..	....	..	..	..	....	3	....	3
Idaho	..	....	..	.....	1	1	..	....	..	..	..	2	....	2	....
Illinois	..	....	1	1	51	52	3	....	1	4	9	191	175	195	184
Indiana	..	....	..	.....	7	7	6	....	..	6	6	37	77	43	83
Kansas	9	....	3	12	76	88	46	....	13	59	41	263	239	322	280
Kentucky	3	....	..	3	6	9	6	....	1	7	13	24	18	31	31
Louisiana	4	1	..	5	35	40	7	8	..	15	22	133	112	148	134
North Louisiana	..	....	..	.....	8	8	1	....	..	1	2	49	39	50	41
South Louisiana	4	1	..	5	27	32	6	8	..	14	20	84	73	98	93
Michigan	1	....	..	1	14	15	2	....	..	2	2	64	80	66	82
Mississippi	..	....	..	.....	12	12	2	....	..	2	..	57	47	59	47
Missouri	..	....	..	.....	30	30	..	....	..	..	..	11	5	11	5
Montana	..	....	..	.....	5	5	1	....	..	1	2	28	29	29	31
Nebraska	6	....	..	6	13	19	14	....	..	14	7	74	36	88	43
Nevada	..	....	..	.....	....	....	..	....	..	..	..	3	2	3	2
New Mexico	1	....	1	2	14	16	8	1	3	12	15	44	61	56	76
North Dakota	..	....	..	.....	3	3	..	....	..	..	1	12	31	12	32
Ohio	..	....	..	.....	3	3	..	....	1	1	..	9	3	10	3
Oklahoma	7	....	1	8	49	57	29	4	8	41	48	172	227	213	275
South Dakota	..	....	..	.....	2	2	..	....	..	..	1	4	5	4	6
Texas	39	5	1	45	294	339	171	24	23	218	241	1,326	1,306	1,544	1,547
Dist. 1: South Central	3	1	..	4	36	40	7	3	..	10	12	138	75	148	87
Dist. 2: Middle Gulf	..	1	..	1	19	20	4	4	4	12	11	75	82	87	93
Dist. 3: Upper Gulf	3	1	..	4	28	32	7	7	3	17	14	131	125	148	139
Dist. 4: Lower Gulf-S.W.	..	1	..	1	31	32	9	5	2	16	17	132	128	148	145
Dist. 5: East Central	..	....	..	.....	7	7	3	2	..	5	..	44	39	49	39
Dist. 6: Northeast	..	....	..	.....	7	7	1	....	..	1	2	50	44	51	46
Dist. 7-B: North Central	7	....	1	8	67	75	47	....	7	54	71	299	282	353	353
Dist. 7-C: West Central	2	....	..	2	17	19	10	....	4	14	20	84	110	98	130
Dist. 8: West	13	....	..	13	35	48	32	....	1	33	41	148	140	181	181
Dist. 9: North	11	....	..	11	40	51	50	....	2	52	46	211	266	263	312
Dist. 10:Panhandle	..	1	..	1	7	8	1	3	..	4	7	14	15	18	22
Utah	..	....	..	.....	8	8	2	....	1	3	3	24	9	27	12
West Virginia	..	....	1	1	1	2	..	....	3	3	..	8	....	11	....
Wyoming	1	....	..	1	6	7	8	....	1	9	30	45	66	54	96
Total United States	78	6	10	94	709	803	331	38	63	432	472	2,935	2,829	3,367	3,301

Wildcatting Holds Lead

Four-months' total 2 percent ahead of 1954.

By CECIL W. SMITH, WORLD OIL Staff

WILDCAT DRILLING continued its brisk rate through April, and although this year's completed tests lost some of their lead over record 1954, they still hold a 2 percent advantage. That means that in the first four months, this year has seen more wildcats drilled than any comparable period in history.

So far, a total of 3367 wildcats has been completed, compared to the 3301 recorded in the first four months of 1954. At the end of March, activity held a 5 percent edge, but April's wells failed to match those of last year's by 66, thereby cutting the year's lead to 66 wells or 2 percent.

Despite the increase in this year's tests, success did not measure up to last year's score. In four months, 432 tests were successfully completed as new field openers. A year ago, the count had been 472 new area discoveries. Statistically, this year's efforts have been rewarded with a 12.8 percent success rate, while last year's period enjoyed a 14.3 percent score.

The states where wildcatting has gained or lost this year in comparison with 1954 are fairly well divided, with the number showing increases having a slight edge. However, each list carries a number of the leading drilling areas.

The most active state, Texas, ended the four-months period almost even with last year, but on the minus side with a deficit of three completed wildcat tests. The totals being 1544 to 1547 last year.

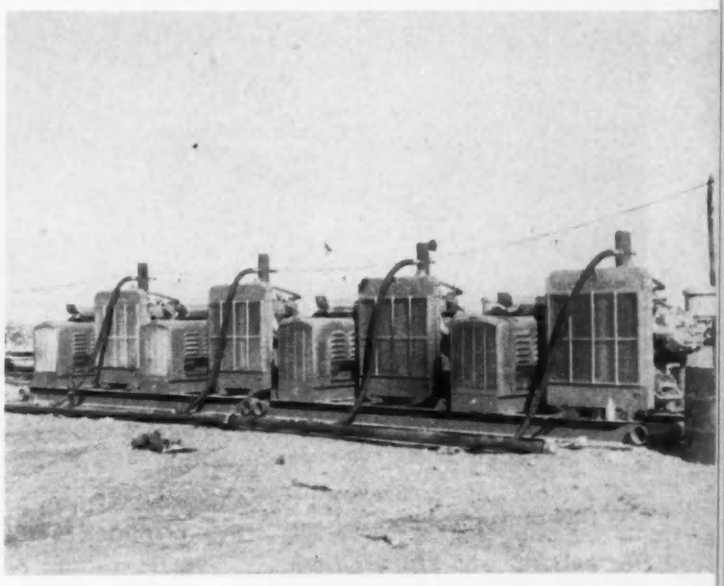
The second most active wildcatting area was Kansas, where operations resulted in a gain in completions from 280 last year to 322. The most pronounced increase occurred in Colorado, where 259 completed wildcats boosted that state into third place in the nation. Last year's tests totaled only 146. Colorado and Utah were the only Rocky Mountain Sstates to register increases this year.

Oklahoma's activity included 213 wildcats, but that was a drop from last year's 275, and which resulted in the state slipping from third to fourth place.

Summary of Results of Wildcat Drilling

ITEM	April, 1955	Mar., 1955	FOUR MONTHS January-April 1955	1954	Percent Diff.
New Field Discoveries:					
Oil	78	79	331	361	— 8.3
Distillate	6	19	38	34	+11.8
Gas	10	15	63	77	—18.2
Total Discoveries	94	113	432	472	— 8.5
Dry Wildcats	709	709	2935	2829	+ 3.7
Total Wildcat Tests	803	822	3367	3301	+ 2.0
Percent Productive	11.7	13.7	12.8	14.3	....
Percent Dry	88.3	86.3	87.2	85.7	....

One 600-cubic-foot per minute and two 310-cfm, 125-pounds-per-square-inch rotary machines manifolded for small-hole drilling.



Four 500-cfm, 240-psi positive displacement compressors; each driven by four-cylinder diesel engine.

Air Drilling Is Developing Rapidly

Many problems still exist, but progress to date promises that additional experiments and experience may solve these and improve today's practice.

By M. M. BRANTLY, President, Brantly Drilling Company, Inc., Midland, Texas,
and **F. W. Smith,** President, Technical Drilling Service, Inc., Midland, Texas

THE USE OF AIR as a circulating medium has begun to receive considerable attention in the never-ending search for faster and more economical methods of drilling. This is especially true in the West Texas-New Mexico area, where a sizable amount of air drilling has been done. Rapid progress has been made to date. Additional experiments and experience are needed to solve some of the remaining problems.

Originally air was used primarily to combat lost circulation and that undoubtedly will remain one of its primary functions. However, it has been found that in most formations penetration rates are increased and bit life is extended greatly by the use of air.

Since, in the beginning, the requirements as to volume and pressure could only be estimated it has been found necessary to use air compressor equipment which was readily available. In general this equipment consists of 315 and 600 cubic foot per minute rotary machines which are built primarily for construction and mine work. One advantage of these machines is the ease with which additional units may be added to the system when needed. The primary disadvantage is that being rotary-type compressors their pressure is limited to approximately 125 pounds per square inch and also the volumetric efficiency declines very rapidly in the upper pressure range.

As more is learned about the volume and pressure requirements it will be possible to design equipment which will more nearly meet the needs of the drilling industry. There are already two service companies supplying compressor equipment which has been assembled for drilling. This equipment consists of positive displacement compressors with operating pressures in the range of 200 to 250 pounds. Although in normal drilling the required pressure is not this high, the fact that normal operating pressures fall in the middle of the capability range of the machines allows them to operate at a high efficiency.

Factors to consider. In determining the requirements for any particular air job there are several factors which must be taken into consideration.

1. It has been fairly well agreed that an annular velocity of 3000 feet per minute is necessary to properly clean the hole under normal conditions. In order to arrive at this veloc-

Air drilling without a dust separator in the Yarborough and Allen field, Ector County, Texas.

ity the volume must be varied to fit the hole size and drill pipe size.

2. The penetration rate expected in the formations to be drilled must be kept in mind. The faster the formation will drill, the more volume is required in order to clean the hole rapidly and eliminate the necessity of circulating for extended periods before making connections or trips.

3. Apparently using more air than is required to adequately clean the hole does not increase the efficiency of the operation. As a matter of fact it probably works the other way by increasing the standpipe pressure, thereby putting an increased load on the compressors and compressor engines. This will also cause an increase in air temperature which if not eliminated by the use of adequate coolers will subject the rotary hose, swivel packing, and rotating head to unnecessarily severe wear.

4. In the case of drilling large holes, it may be impractical to use sufficient compressors to obtain the desired annular velocity by conventional circulation. In this case the volume requirements can be materially reduced by drilling with reversed circulation.

In almost all cases it is desirable to keep the air temperature as low as possible. This will greatly reduce the wear and tear on all components of the circulating system. An exception to this is when an attempt is being made to dry up moisture in the hole. During this process, where practical, coolers should be bypassed and the air permitted to enter the hole at a high temperature. As soon as the hole is dry the air should again be routed through the coolers.

It is especially important to keep the air temperature as low as possible when drilling through an oil-bearing zone.

Hot air will drive off the light ends in the oil and the residue mixing with the cuttings will form a gummy substance which is hard to blow out of the hole.

Fluid seal needed. To date there has not been a satisfactory method developed of combating formation fluid which may be encountered while drilling. There have been a few experiments performed in attempting to seal off formation water, but a great deal of work must still be done if this problem is to be satisfactorily overcome.

When water is encountered it mingles with the cuttings and may form a putty-like mass which will cling to both the drill pipe and the sides of the hole. If care is not taken this build up may finally cause the sticking of the pipe. If equipment with an adequate pressure range is available the hole may be cleaned by the addition of water which will thin the cuttings to a point where they may be blown from the hole.

If a satisfactory squeeze method can be developed it would appear that the best approach would be to drill through the fluid bearing strata then perform a squeeze job and continue drilling. One of the primary problems existing now is the lack of a squeeze system which can be used in a dry hole with sufficient cement or plastic to accomplish the desired purpose. It is, of course, possible to shut off the water with a conventional squeeze job. But this would require considerable time since the hole would again have to be dried out completely before drilling could be resumed. It is also possible that some of the formations which have been penetrated would be very susceptible to hydration and, therefore, be a source of serious trouble.

From the standpoint of the geologists attempting to run samples on a hole being drilled with air, it is initially a considerable handicap. Since, in general, the cuttings have a consistency very similar to flour, it is difficult to obtain positive identification. With some practice it is believed that the very finely ground cuttings can be identified with sufficient accuracy for the work being done. On the other side of the ledger is the fact that all cuttings come to the surface with no contamination or washing. Also, even the lowest pressure oil or gas bearing zones can be detected since there is no pressure against them nor is there a wall cake building medium to seal them off. In effect the entire operation has many of the characteristics of a drill stem test.

Explosive mixtures unlikely. There has been some discussion of the dangers of down hole explosions occurring when a gas bearing zone is encountered. It is true that there have been several such explosions, but to date there have been none, known to the author, which have occurred under routine drilling conditions. In the first place it is quite unlikely that the mixture needed for explosion would be obtained. Also, during routine operations there is no way in which the needed pressure would be obtained.

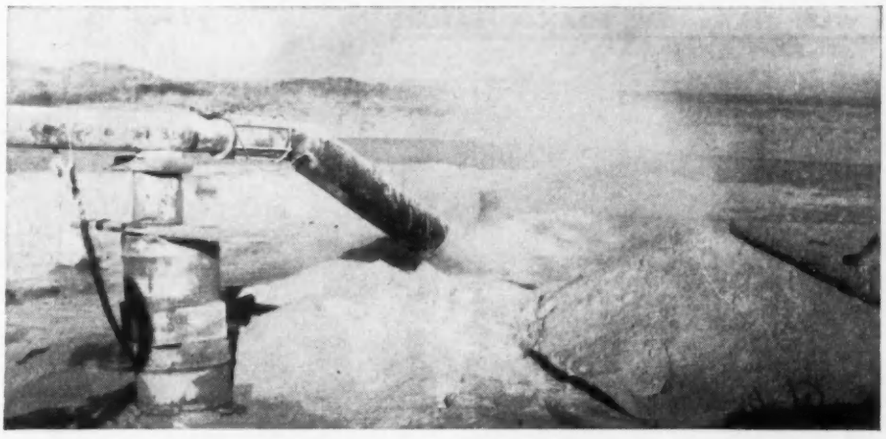
It is possible, with a gas-bearing zone open in the hole, to obtain an explosive mixture, and should the blowout preventer or flow valve be closed necessary pressure conditions could be met. One down-hole explosion is known to have occurred when the flow line valve was closed momentarily in an attempt to build up additional pressure to assist in cleaning the hole.

Since in air drilling there is no mud column to control pressure zones, any oil or gas bearing strata which is under

pressure will "blowout," but normally this should be no cause for concern. As a matter of fact a moderate gas blow would theoretically assist in cleaning the hole. The oil or gas will pass through the flow line and be exhausted with the air. It is considered good practice to maintain good mud in the pits so that should the occasion arise it can be pumped into the hole without any loss of time. Should it become desirable to kill a pressure zone the mud pump would be started and the air in the hole allowed to exhaust through the flow line or be released through a suitable pressure release line located below the blowout preventer. By this method the well could be completely controlled in a matter of a very few minutes.

Fire hazard exists. It is important on air drilling operations to properly train the personnel in the dangers which are inherent in the system. The primary danger is fire caused by the escape of gas through the rotating head or a leak in the flow line. Normally it is considered good practice to designate an area where smoking is permitted and to require all personnel to leave cigarettes, cigarette lighters, matches, etc., in that area. In cool weather where a fire is necessary, the change house should be located several hundred feet from the rig on the windward side. A fire can then be used when necessary to permit the personnel to warm themselves. If it is known that a gas bearing zone is open in the hole, care should be taken to prevent the accumulation of gas under the substructure and in the cellar, and all personnel should be warned to stay out of possible gas traps.

All engines should be equipped with water cooled exhaust manifolds and water should be injected into the exhaust lines. If lights are to be used on the rig itself, they should be vaporproof and all wires should be inspected for breaks in the installation. Some contractors as a matter of habit, disconnect all lights on the rig itself and depend on flood lights placed away from the rig for illumination.



A water-spray dust settling device.

Although it is not actually a hazard, care should be taken to control the dust around the rig. Unless it is properly lubricated and a good stripper rubber used, the rotating head may allow considerable dust to escape under the floor. The constant presence of this dust is not only unpleasant, but it can be detrimental to the eyes and lungs of the personnel. In addition to this it may be extremely hard on the rotary table and other moving parts of the rig. A mixture of bentonite and water poured on the top of the stripper rubber or on the kelly above the stripper rubber will both minimize the wear on the rubber and assist in making a dust tight seal. The flow line should be unrestricted and of such size as to relieve the rotary head of all possible back pressure.

Cores not contaminated. To date both conventional and diamond cores have been cut using air as a circulating medium. In all cases known to the author the penetration rates have been at least as good as with mud and in most cases has been from 25 to 100 percent higher.

There has been at least one case in which a diamond bit was heated excessively while drilling with air, but it is believed that by the use of properly designed bits and a sufficient volume of air, this difficulty can be completely eliminated. It also has been found that a diamond bit which is too dull for coring with mud will still cut at a reasonable rate using air.

One great advantage to the use of air is the fact that the core is not subject to either contamination or washing, thereby simplifying field evaluation of the formation being cored.

Normal Fishing Procedures. In an air-drilled hole, fishing operations present no more of a problem than in one drilled by conventional methods. Overshot and taper tap fishing is done in the normal manner and washover jobs present no particular difficulty.

In cases where the hole has not been cleaned sufficiently before making connections, and cuttings have been allowed to settle around the drill collars, it is often possible, by a combination of air pressure and pipe movement, to free the pipe without a great deal of effort. Such troubles as the build up of excessive wall cake in porous zones are, of course, completely eliminated.

Completions. By using air, wells may be completed with rotary tools without any danger to the pay zone.

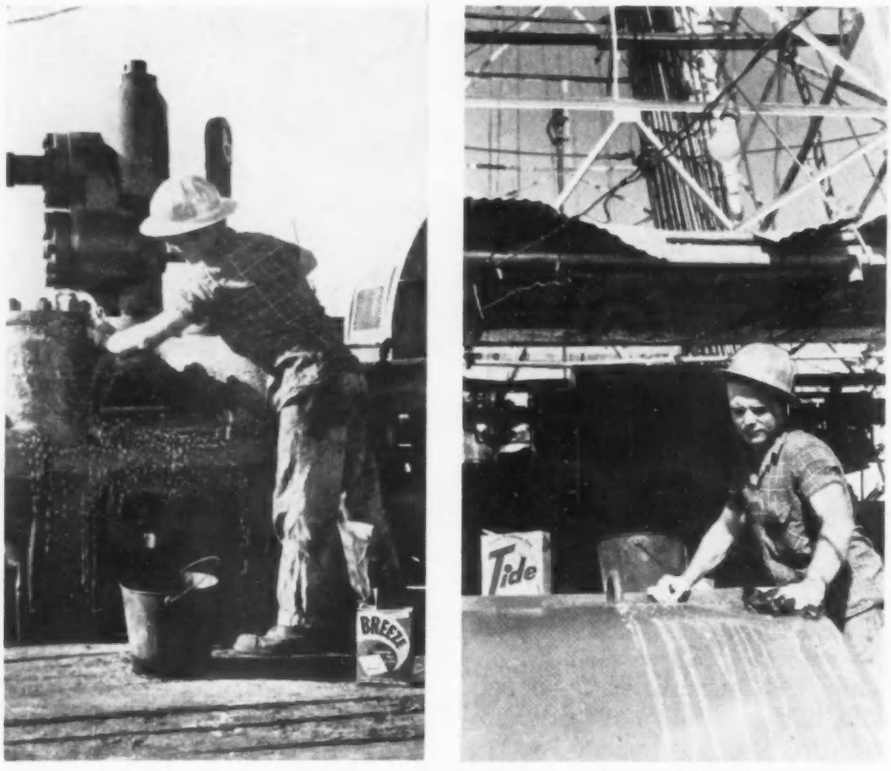
For recompletion or clean out work air should also be an extremely valuable tool due both to the speed with which the work can be done and the lack of danger of damaging the formation.

It is known that as long ago as 1936 gas was used for drilling-in with rotary in lieu of cable tools in certain in-

Continued on Page 192

TABLE 1

AREA		Interval	Bits Used	Rotating Hours	Penetration Rate 1/Hr.
D-K Abo	Mud	3085'-4497'	12	231½	6.1
Lea Co., New Mex.	Air	3070'-4463'	2	56¼	24.8
Skaggs Field	Mud	2565'-4300'	11	151	11.5
Lea Co., New Mex.	Air	2710'-4347'	7	100	16.4
Townsend Field	Mud	4630'-5706'	10	84½	12.7
Lea Co., New Mex.	Air	4680'-5752'	3	65½	16.4



Detergents are replacing petroleum-type cleaners on some rigs in West Texas. Left, a pump is being washed down and, right, V-belt guard gets a scrubbing.

It's Rig Washing Time In the Permian Basin

And detergents are replacing petroleum-type cleaners because they are easier on the paint job.

THE WEST TEXAS roughneck has learned a trick from his wife and her idea is saving money for contractors. Long ago the roughneck's wife learned the virtues of detergent type soaps. Today, detergents are sold in carload lots throughout the Permian Basin to wash down drilling equipment.

Previously, the general practice was to wash sand-laden oil film from rig equipment with diesel fuel or kerosine. Usually the rig was repainted one or more times while on a specific location because of the contractor's pride in good housekeeping.

Frequent baths of petroleum rig washes caused an accelerated deterioration of expensive rig enamel. Now, detergents similar to those used in the Monday morning home laundry or in the dishpan, do an effective job of washing away the dust-dulled oily film. The detergent does not attack the paint.

The switch from kerosine and other petroleum-type cleaners to detergents for rig washing has been rapid during the last two years.

One West Texas distributor of a detergent reported sales of approximately 20,000 pounds for rig washing during 1954.

If it is good enough for your wife's hands, it is good enough for your rig!

—The End

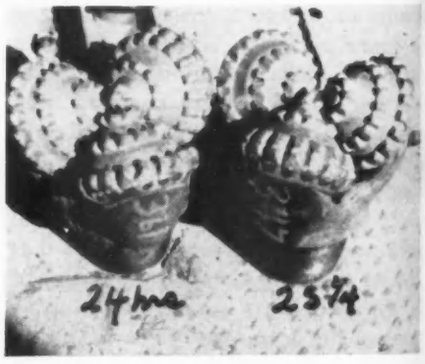
Air Drilling

Continued from Page 191

stances in the Texas Panhandle. Other records show at least one use of gas to clean out after a shot in the Monument field of Lea County, New Mexico. Apparently the supposed fire hazard involved was one of the primary reasons that more work was not done with gas until fairly recently.

In areas such as Farmington, N. M., it is now common practice to drill-in with gas. After the proper equipment is added to a rig, and the personnel are trained to observe safety regulations, there is no outstanding danger involved.

Faster penetration rates. In recent months there have been many articles concerning the use of air and gas in drilling operations, and there has been much data published, however, it might be interesting here to review the statistics on a few comparative wells. (See Table 1.)



Two 7⅞-inch bits used in air drilling in limestone. Bit at left cut 361 feet in 24 hours. Bit at right cut 347 feet in 25¼ hours.

As can be seen from the table, the use of air not only has increased penetration rates, but has greatly increased bit life, thereby improving the percentage of time on bottom.

Air drilling is still in its infancy. Much work has yet to be done before it can take its place in the industry as an accepted drilling method. The benefits which have been derived from the use of air, both in combating lost circulation and in increasing penetration rates, would indicate that any experimenting done on its use will be of great benefit to the industry.

—The End

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Wilson

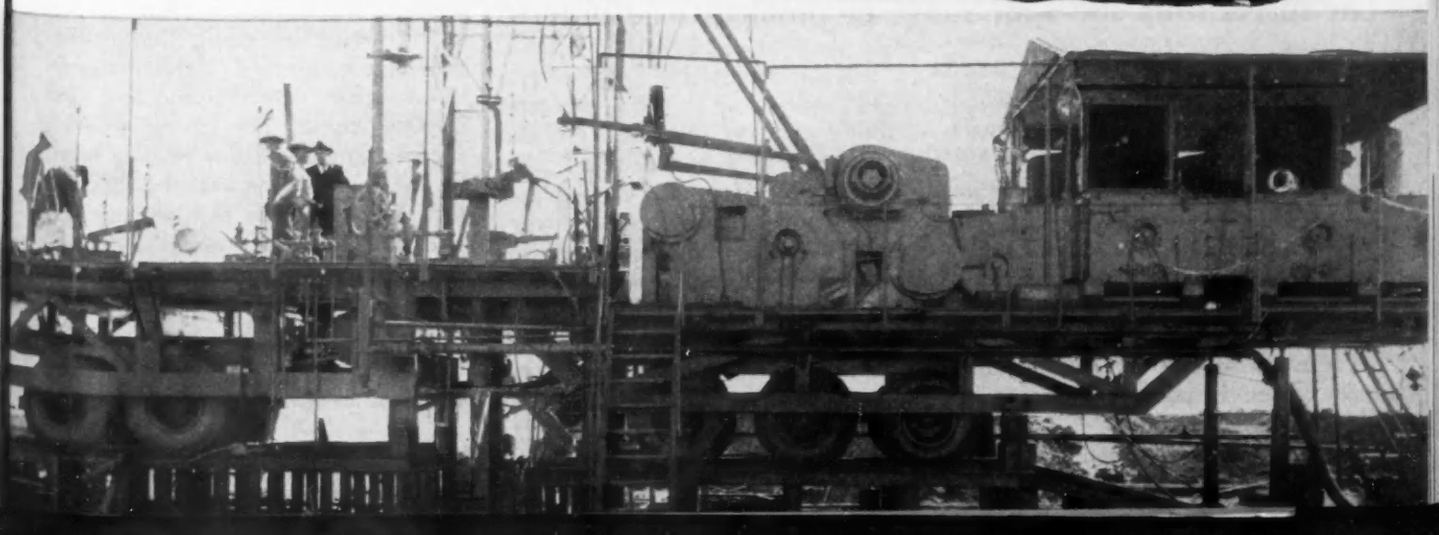
Amazing . . You bet it's amazing . . This new Wilson Dual Trailer Rig is one of the fastest big rigs available anywhere for medium depth drilling. It is also recognized as one of the most revolutionary rigs to hit the industry in fifteen years.

Constructed of the finest "Manten" steel and mounted on a separate trailer, the mast has less than 75′ overall length and 10′ width including truck, when folded for transporting. The fifth wheel is built into the upper section so that the tractor can be backed directly under it. The Wilson Giant Torcair Two-engine Rig is mounted on the other trailer so that the entire unit can be quickly and easily transported from location to location.

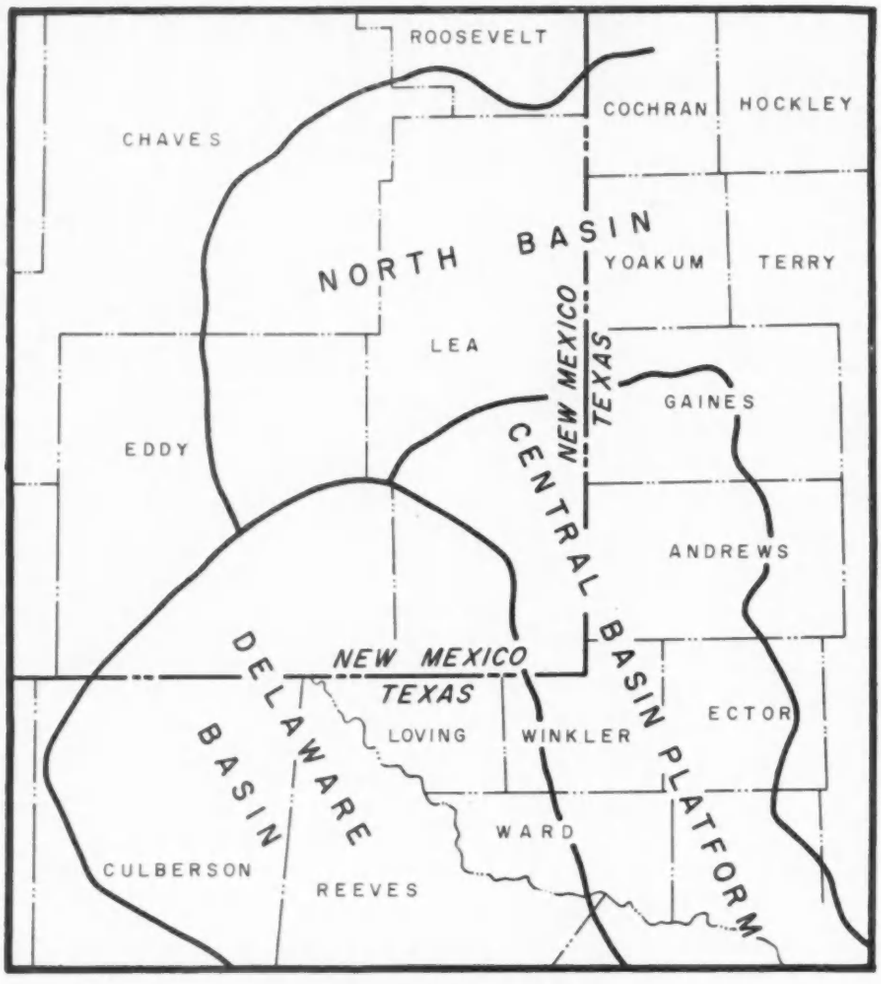
This complete new rig, proven under extreme field conditions, definitely solves the problem and need for portability in a medium depth drilling rig. Another plus is that the operator has a mast of rigid design that can be used under any conditions.

●*Photo at left:* Here is an overall view of the rig with mast extended to full height. Note that the only guys needed are side "wind-guys" attached to outriggers extending from the ramps. The guyless feature saves many hours during rigging up operations and is especially valuable in swampy or rocky areas.

●*Photo below:* An overall closeup view of the two trailers as they are positioned over the hole. The ramps under the trailers are placed so that trailers line up perfectly, with little effort and time. The ramps also provide added height to clear blowout preventers. Note the large working area on the derrick floor.



A WEST TEXAS-NEW MEXICO FEATURE



SOUTHEASTERN NEW MEXICO

Mud Practices Vary Greatly In Southeastern New Mexico

Careful attention must be given to mud to combat successfully the wide range of problems encountered in different parts of the area.

By W. E. SCHULTZ, Shell Oil Company, Midland, Texas

SUCCESSFUL DRILLING operations in southeast New Mexico require that careful attention be given to mud programs. In some parts of the area, subsurface formations present troublesome zones. In addition to being influenced by a wide range of well depths, pressure, lost circulation problems, and types of formations encountered, different mud programs are necessary in the various geological regions. Consequently, drilling mud programs in southeast New Mexico vary greatly.

The area discussed includes Lea County, parts of Eddy and Chaves counties, and a portion of Roosevelt County. The major tectonic features in this region, all of which extend into West Texas, are the Central Basin Platform, the Delaware Basin, the area north of the Central and Delaware Basins which will be referred to as the North Basin, and the Matador Arch at the extreme northern boundary.

CENTRAL BASIN PLATFORM

The Central Basin Platform in New Mexico covers about one-fifth of Lea County in the extreme southeast corner of the state. This has been an area of concentrated drilling activity with the numerous fields forming a trend in a north-south direction. The Permian formations are found to exhibit much uniformity in thickness throughout the Platform area with a gradual thickening extending north into the North Basin. On the west flank of the Platform, beds dip steeply into the Delaware basin. Pre-Permian formations are generally found with considerable faulting and folding with steeply dipping beds in localized areas. Widespread erosion after Pennsylvanian time left little Pennsylvanian on the Platform and exposed older formations to localized erosion in faulted and folded areas. Erosional unconformities also exist in Pre-Pennsylvanian formations and through the older formations of Paleozoic time.

Mud programs and problems. The mud programs in the Platform area can be divided into three categories as a result of the casing programs employed. The casing programs are defined as (1) surface casing and production casing, (2) surface casing, short intermediate casing, and production casing, and (3) surface casing, intermediate (salt) casing, and production casing. The casing program used in any particular field is based on the depth of the well and localized conditions, such as high-pressure gas and lost circulation, and the over-all occurrence of incompetent red sand and shale beds overlying a massive evaporite section.

The first casing program given above is used in shallow wells, nor-

mally not exceeding depths of 5000 feet. The mud programs are relatively simple, although complications often occur from erosion and caving of the evaporative and red shale formations, made more difficult on occasion by gas "kicks" or blowouts from the Yates formation. Also, adding to the complexity of the blowout and caving problem, is the existence of charged upper formations in the vicinity of older producing fields, creating an abnormal pressure gradient often difficult to control.

The surface casing is normally 300 feet or less in depth. Fresh water clay or bentonite is mixed for spudding and for maintenance of an API funnel viscosity of 50 or better while drilling the surface sands and shales. This mud is discarded after drilling out of the surface casing, and a native red shale mud, continuously diluted with water for maintenance of an API funnel viscosity of 35 is used.

The Rustler anhydrite formation is encountered below the red sand and shale beds at depths ranging from 1200 to 1600 feet. Below the Rustler the massive salt section containing stringers of anhydrite and shale is encountered, after which the Yates sand formation is found at approximately 2800 feet. The native "red bed" mud becomes saturated with salt when penetrating the massive salt section and weighs 10.5 to 11.2 pounds per gallon upon reaching the Yates. The Yates formation, and sometimes the Seven Rivers formation below contain gas pressures sufficiently high to gas-cut the native mud and sometimes cause serious blowouts if excessive dilution reduces the mud weight sufficiently.

When serious Yates trouble is anticipated, the second casing program given below is often used for added safety. On the other hand, a limited amount of gas-cutting in this interval is a common occurrence, and wells are frequently drilled to lower formations, such as the Queen, Grayburg, and San Andres, with the gas-cut mud producing occasional "kicks" without resulting in serious hole trouble. However, when using a casing and mud program of this nature, it is important to allow the native mud to increase in weight to 11.0 to 11.2 pounds per gallon by control of water dilution; thereby attaining sufficient weight to control the larger gas accumulations such as are found in the Monument area in particular, and in other known areas of Yates gas accumulation in New Mexico. The native mud is usually enriched with starch to reduce the filtration loss prior to penetrating a pay zone.

The second casing program is sometimes used, in lieu of the program above, where the Yates gas is known to be a serious problem. In this event, a short intermediate casing is set in the first thick anhydrite stringer after penetrating the red sand and shale section and before entering the massive salt section. Caving and lost circulation in the incompetent "red beds" is therefore eliminated when drilling ahead and control of the Yates gas is simplified.

In some wells the mud weights are increased to 12 and as high as 14 pounds per gallon in drilling the Yates. However, it is apparent that a native mud weight of 11.0 pounds per gallon is sufficient to hold the gas pressure in the majority of cases, providing safe drilling practices, such as keeping the hole full at all times and making trips at a reasonable rate, are followed.

In this manner a native mud can be used to the top of shallow productive zones before adding starch and salt water clays for completion purposes and setting the production casing.

The third casing program is used in the deeper wells in the Platform area. In this case the intermediate string becomes a "salt" string and is set in hard lime, below the Yates formation, casing off all of the massive salt section. In drilling the "salt hole" the surface mud pits are cleaned and the volume jetted low prior to encountering the salt formation. Because the entire "salt" casing is normally cemented from bottom to top, pretreatment of the mud system with salt is sometimes practiced to reduce hole enlargement.

However, pretreatment is not necessary for good hole conditions, and the economic value of pretreating, as related to cementing costs, is questionable. The thickness of the salt section ranges from 1000 to 1200 feet, and the important consideration while drilling in the salt is in the control of the amount of fresh water addition. Proper settling facilities in the surface pit arrangement permit a reduction in the fresh water required for dilution purposes.

With the casing string set into the hard limestone below the Yates formation, no appreciable salt is found when drilling below this point in the Platform area, and fresh water muds can be used. The formation penetrated below the casing point are primarily carbonate rocks with anhydrite stringers, and because of the low permeability of these formations in many fields, clear water can often be used to the top of the producing zone. In some cases, excessive amounts of water, in the order of 100 barrels per hour, are lost to permeable zones in the lower San Andres, Glorieta, and Clear Fork formations, necessitating "mudding-up," but rarely requiring excessive amounts of fibrous and flake materials to effect a seal.

A considerable chemical treatment of the fresh water muds employed is necessary to maintain desirable properties when drilling below the intermediate casing and through the formations of Permian age, all of which have large quantities of anhydrite stringers. Conventional low-pH-soda ash, low-pH-caustic-quebracho-CMC, and high-pH-caustic-quebracho muds are used through the contaminating formations. Little contamination is found in Pre-Permian formations.

Crude oil or diesel oil is added to any of the above mud systems, for improved mud properties and drilling performance, when sample interpretation will permit. Mud weights and viscosities are normally low, 9.0 to 9.5 pounds per gallon and 35 to 45 seconds per quart. Water losses are in the range of 10 to 20 cc per 30 minutes, and are reduced in pay zones. Larger quantities of shale are encountered in Pre-Permian formations, along with steeply dipping formations in faulted and folded areas, resulting in hole difficulties normally corrected with higher viscosities and lower water losses. Mud viscosities are frequently raised in the range of 60 to 70 API with water losses below 8 cc in 30 minutes. Lost circulation often occurs in the vugular and fractured formations; however, the losses are usually not extreme, and are sealed with fibrous, flake, or granular materials.

NORTH BASIN

The North Basin covers the northeastern part of Eddy County, southeastern part of Chaves County, south-

ern part of Roosevelt County, and the major part of Lea County, New Mexico. Generally, the western flank of the basin is dipping as a result of uplifting in the Guadalupe-Sacramento mountainous region to the west. Formations of Permian age increase somewhat in thickness to the north towards the deeper portion of the basin or shelf, then decrease slightly in thickness in forming a slight arch at the Matador uplift.

Some of the Upper Permian formations, such as the red sand and shale beds and the massive evaporite section, have been removed by erosion at the extreme west. Salt deposits occur in Permian formations of Upper Leonard age in the northern part of the basin, but do not appear in the southern part. Pre-Permian formations are found with considerable faulting, and erosional unconformities exist in the older formations of Paleozoic time.

Mud programs and problems. The presence of the upper Permian red sand and shale beds and massive evaporite section in the major part of the North Basin, and specifically in the main area of activity, results in the same casing and mud programs in these upper formations that are employed and previously described in the Central Basin Platform area. For this reason, the discussion will concentrate on the drilling and mud problems encountered in the deeper drilling found most prominent in the recent development in the basin.

In the deeper wells in the basin, the surface casing usually is set at 350 feet or less, and the intermediate (salt) casing is set into the top of the San Andres carbonate rock, normally occurring at 4000 to 5000 feet in depth, thereby excluding the upper sands and shales and the massive evaporite section. Clear water can be used below the intermediate casing point in some fields to depths as great as 10,000 feet before sufficient shale or permeability is encountered to require "mudding-up."

Normally a mud is required prior to penetrating the Wolfcamp formation of basal Permian age, containing sufficient shale stringers to cause hole trouble, below which a considerable amount of trouble-making shale is encountered in formations of Pennsylvanian and Mississippian age. Probably the best known trouble-making shale in the basin is the Woodford shale of basal Mississippian age. Not to be excluded from the category of trouble-making shales is the Abo shale of lower Leonard age, found most troublesome in the northern part of the North Basin at depths of 7000 to 8000 feet.

The depths below the intermediate casing point at which a drilling mud is necessary, therefore, may vary considerably in the large expanse of the North Basin. As in the Central Basin Platform area, all formations of Permian age contain considerable amounts of anhydrite and require large chemical treatments when fresh water muds are employed. The fresh water muds employed are of the low pH-caustic-quebracho, low pH-caustic-quebracho-CMC, and high pH-caustic-quebracho types. The mud properties of these fresh water muds through the Permian formations to a depth of approximately 10,000 feet, are generally in the order of 8.8 to 9.5 pounds per gallon weight, 35 to 50 API funnel viscosity, and 10 to 15 cc in 30 minutes water loss. In drilling through Pre-Permian formations to depths exceeding 13,000 feet, the funnel viscosity is normally increased uniformly to upper limits of 70 to 90 seconds API. Mud weights are usually kept low except in specific abnormal pressure areas, and water losses range from 5 to 10 cc in 30 minutes.

Salt water muds are necessary when "mudding-up" below the intermediate casing point in the northern part of the North Basin, because of salt deposits occurring at 5000 to 7000 feet in the Yeso formation of upper Leonard age. The muds are saturated with salt very shortly after encountering the salt stringers, and with subsequent drilling and dilution with fresh water, the salt content gradually lowers to approximately 25 percent of saturation in some 4 to 5 weeks.

Pretreatment with salt is expensive and not necessary for good hole conditions. The salt water muds are simply made up of salt water clays for building viscosity and starch for reducing water loss. Since the salt content remains above 20 percent only a short period of time, a starch perservative is also necessary. Mud properties are generally in the range of 9.8 to 10.2 pounds per gallon weight, 40 to 60 API funnel viscosity, and water loss in the range of 5 to 15 cc in 30 minutes.

Crude oil or diesel oil is added to both the salt water and fresh water mud systems for improved mud properties and drilling performance, when sample interpretation will permit.

Crooked hole difficulty and lost circulation, in addition to the shale difficulty mentioned previously, are probably the two main offenders in North Basin drilling. Abnormal pressure zones have been encountered, resulting in blowouts and fires, and may add appreciably to the lost circulation problem with future development in the basin. Lost circulation usually occurs most prominently in the lower Wolfcamp and Pennsylvanian carbonate formations; however, losses occur in upper Permian and Pre-Pennsylvanian formations as well.

The Denton field in northeast Lea County is perhaps the best example of the lost circulation problem found in the North Basin. Some of the most difficult and severe loss circulation found in the U. S. has occurred in the Denton field. The high frequency of losses of enormous magnitude and the various methods used in combatting these losses in this field have made it quite unique and a frequent source for reference.

No correlation or trend of lost circulation is apparent, with losses scattered throughout the entire field. The zones of loss occur in the Wolfcamp and upper Pennsylvanian formations covering an approximate interval of 1200 feet. It seems likely that the carbonate rocks in this interval contain solution cavities of relatively large size, judging from drops of 2 to 5 feet of the bit and from drilling breaks of 1-foot/minute in the interval. Complete losses normally occurred abruptly with drilling breaks or "rough" drilling. In this case, the static fluid level in the hole would remain at about 1000 feet with mud weights of 8.4 pounds per gallon. Various types of mud, lost circulation additives, plugs, bridging materials and techniques have been used at one time or another.

In some cases, a combination of bentonite-oil plug followed by cement have been at least partially helpful. After a reasonable number of plugs have been placed but have failed to accomplish results, it has become the practice to blind drill ahead with water. In blind drilling ahead, approximately 100 barrels of high viscosity bentonite-water mixture were normally spotted on bottom prior to making each trip. The holes were kept relatively clean in this manner and

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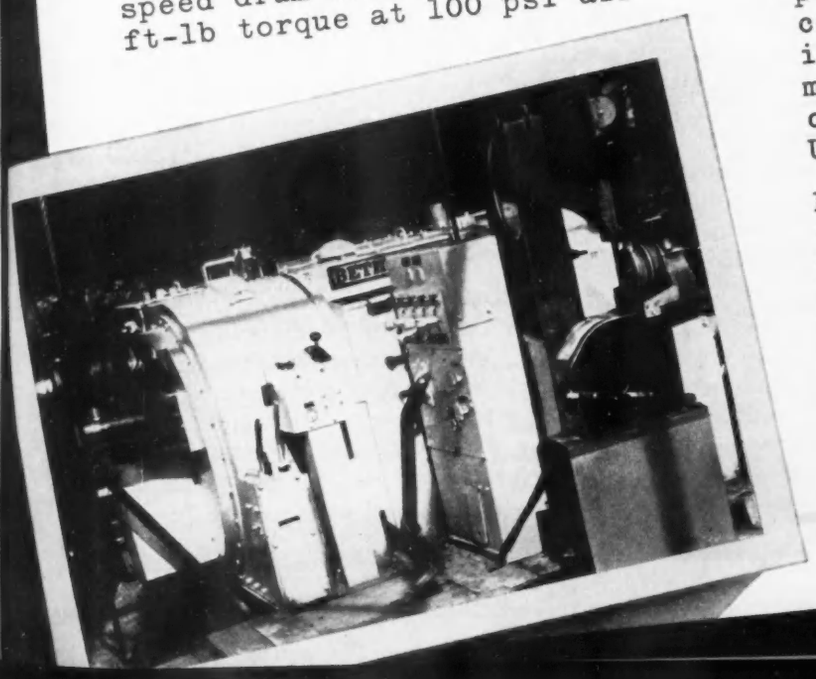

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This unit, too, has amazingly high clutch capacity (low-speed drum clutch, 102,000 ft-lb torque at 100 psi). Another feature is the powerful 52-in. brakes that provide extra safety in all situations. Rig can be furnished with two- or three-engine drive having single or double pump drive; pump drive is Airflex-clutch-controlled. Engine compound is sectionalized. Choice of mechanical drive, fluid coupling, or torque-converter. Upper drum optional.

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drilling proceeded for approximately 1000 feet before running a protective string of casing through the lost circulation zones. Blind drilling ahead with water also effected partial returns in a couple of wells by the deposition of drill cuttings in the cavities, resulting in a complete seal through the addition of high concentrations of bulk materials, or by subsequent spotting of cement. To say the least blind drilling with water has become a recognized method of combatting cavernous losses of the "Denton type."

DELAWARE BASIN

The northern part of the Delaware Basin extending into New Mexico covers the southwestern part of Lea County and the southeastern part of Eddy County. The formations in the basin may generally be characterized at the eastern side of the basin, bounded by the Central Basin Platform, by a thickening of the Ochoa series of upper Permian age, a pronounced gradation in the Guadalupe series from primarily carbonate rock on the Platform to sand and shale in the basin, a thickening of the Leonard series with facies changes from primarily carbonate rock to large percentages of shale and sand, extremely thick shale and sand deposition of Wolfcamp age, and considerable shale deposition of Pennsylvanian age.

The western flank of the basin is gently dipping as a result of the Guadalupe and Delaware uplifts during Tertiary time. The northern boundary, dividing the Delaware Basin and North Basin is formed by a series of carbonate reefs deposited at the northern margin of the basin during the Leonard epoch and in succeeding Guadalupe time.

Mud programs and problems. The deposition of very thick beds of Permian age, and to a lesser degree formations of Pennsylvanian age, having a preponderance of shale and sand along with lesser carbonate rock formations at considerable depths, provides a basis for abnormal pressure zones at the lower depths, complicated by lost circulation difficulties. Until recently the Delaware Basin of New Mexico remained a large unexplored area, with the exception of limited drilling in the very shallow formations of upper Permian age. Exploration of the area with wells projected to the extreme depths of the basin has started and promises to be a drilling and mud problem of major proportions.

The newness of drilling activity in the basin in New Mexico does not permit the standardization of a casing and mud program at this time. However, a generalization of the casing and mud programs employed and problems encountered on some recent exploratory wells is included for discussion.

At the eastern flank of the basin, the surface casing is set into the Rustler anhydrite occurring at approximately 1200 feet. Lost circulation has been experienced in the surface sands and shales at depths of 400 to 800 feet. An intermediate casing is set into the top of the Delaware limestone at approximately 5200 feet, casing off the massive salt section. Sulfur water flow has been experienced in the Castile formation at 3800 feet, requiring a mud weight of approximately 12.0 pounds per gallon to overbalance the flow.

The salt saturated native mud attained when drilling the massive salt section has a weight in the range of 10.5 to 11.0 pounds per gallon, thereby requiring the addition of some weight material. A low pH-caustic-quebracho mud with CMC has been used below the intermediate casing point to the Wolfcamp at approximately 11,500 feet. Mud properties in this interval are in the order of 9.0 to 9.5 pounds per gallon weight, 40 to 60 API funnel viscosity, and water loss of 10 cc in 30 minutes.

Higher pressure zones have been encountered in the lower Wolfcamp and Pennsylvanian formations at depths below 12,500 feet. In future wells where lost circulation is expected it may be necessary to set an additional casing string just prior to encountering this zone.

Other casing programs in the central and north part of the basin generally consist of a short surface casing of 400 to 600 feet set into the Rustler anhydrite, an intermediate (salt) string set through the massive salt into the Castile or Delaware limestone, an additional string set in lower Bone Springs limestone, and production casing. The mud properties in the surface and salt sections are the same as given previously. Minor lost circulation has occurred in Delaware formations prior to reaching the third casing point; however, little difficulty has been experienced, and light weight, low viscosity muds can be employed.

The final hole trouble encountered has been below the third casing point, where a high pressure salt water flow occurred in one well at 12,600 feet, requiring a mud weight of 11.8 to 12.0 pounds per gallon for control. Low pH-caustic-quebracho muds with CMC and lime muds have been employed thus far in recent wells drilled in the basin. Perhaps the greatest difficulty encountered thus far below the third casing point, and anticipated in future wells, is lost circulation of the higher density fluids required for control of gas and salt water flows in basal Wolfcamp and Pre-Permian formations. **—The End**

About the Author

W. E. SCHULTZ was graduated from Texas A. & M. College in 1949 with a degree in chemical engineering and joined Shell Oil Company shortly after as a trainee in the Production department. Schultz' first permanent assignment was at Shell's Elk City, Okla., Production district. After one year he was assigned to the Hobbs, N. M., Production division where he remained until transferred to his present position on the Midland Area staff in early 1954. Schultz at the present time is in charge of drilling fluids and cementation techniques in Shell's Midland Area Production department. He is chairman of the West Texas-New Mexico API subcommittee on cementing, and is a member of the API's Southwestern subcommittee on drilling fluids.

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A WEST TEXAS-NEW MEXICO FEATURE

How to Use the Two-Bridge System To Detect New Gas Shows from Bottom

A qualitative gas change indicates that a new gas formation has been penetrated by the bit. If lithology and other conditions are favorable, the section should be tested for production.

By **JACK E. BLISS,** Rotary Engineering Company, Midland, Texas

GAS READINGS taken at two different voltages are always desirable in the interpretation of hydrocarbon well logging. A high voltage applied to the detector filament creates enough heat to cause catalytic combustion of all hydrocarbon gases. The low voltage applied creates enough heat to burn catalytically all hydrocarbon gases except methane. This data generally has been plotted in one of the following curve patterns:

- The high voltage data plotted as a "Total Combustibles Gas" curve, and the low voltage data plotted as a "Gas Other Than Methane" curve.

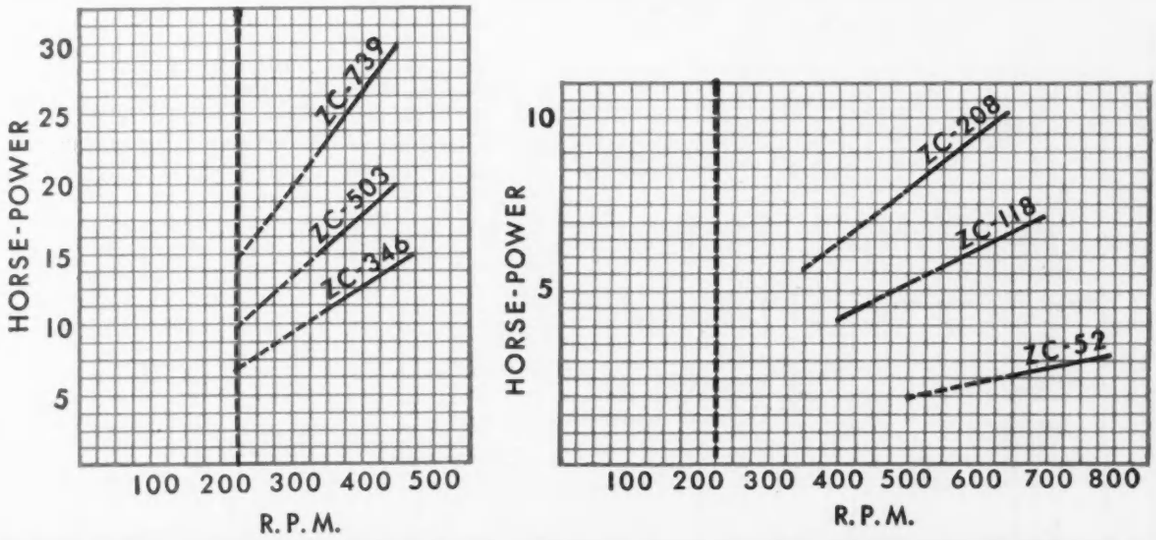
- The high voltage data plotted as a "Total Combustible Gas" curve, and the data resulting from substracting the low voltage readings from the high voltage readings plotted as a "Methane Curve."

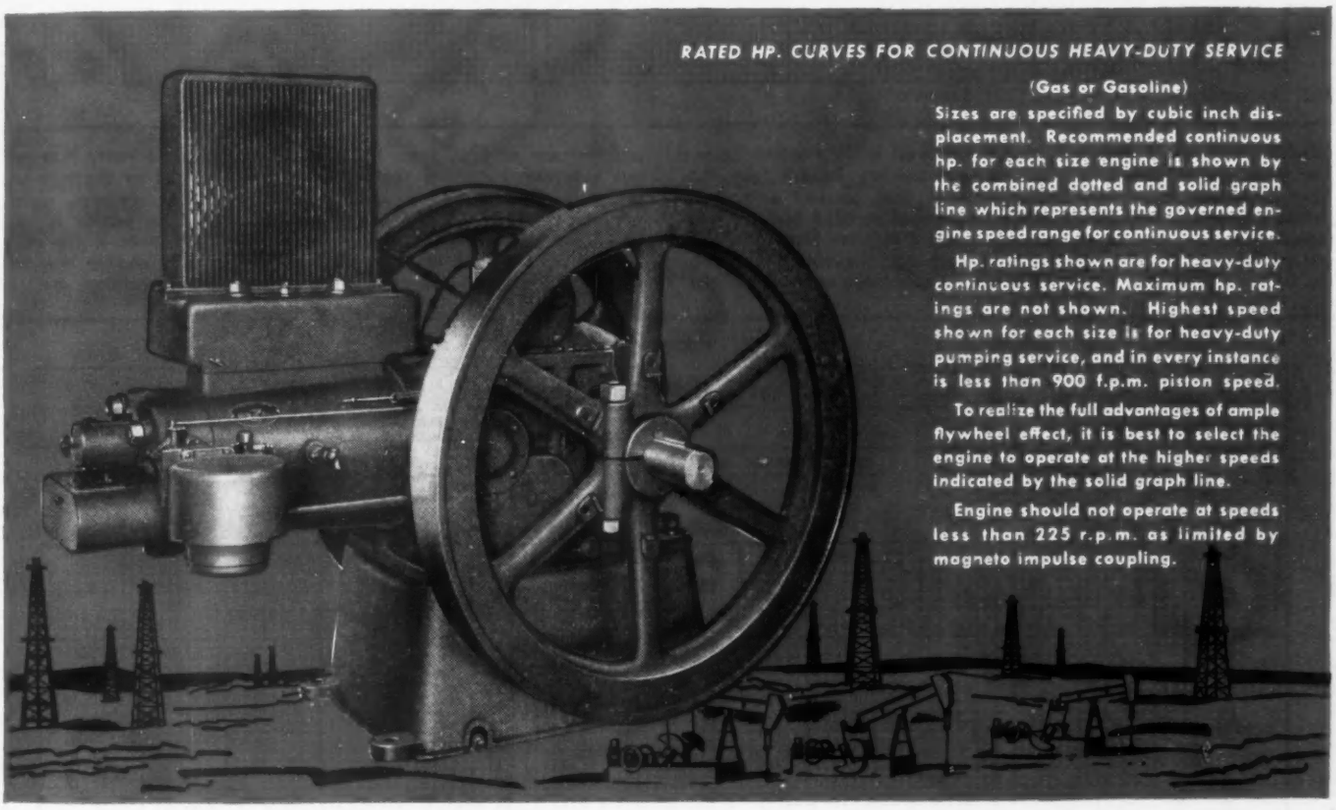
If only one type of hydrocarbon gas is present, the second curve in either of the above patterns is pretty much what the label implies. When the gas is pure methane, a high voltage reading is obtained and no low voltage reading is indicated (except for an extremely high concentration). When more than one gas is present in the mud or cuttings, normally one of the gases present would be methane. When this condition exists (which it often does) if the data are obtained with the correct arrangement of gas detectors, the spread between the two readings is due to the presence of methane, although certainly the percent of methane cannot be computed from this data. An increase in the spread ratio between the two curves represents an increase in methane content. One of the most useful interpretations made in using the two gas curves is examining the curves for a change in the ratio of the low voltage to high voltage gas readings. A change in this ratio indicates a qualitative change in the gas. Such a qualitative change is particularly significant when correlated with a change in lithology, a change in porosity, a drilling break, or an oil show in the cuttings. *In effect, a noticeable change in the ratio of the low voltage to high voltage gas curves indicates that a new fresh gas bearing formation has been penetrated by the bit.* This is often of particular importance when the mud has become somewhat gas cut and continuous gas readings are present, or when gas has been swabbed into the hole during a trip to change bits.

Technique development in interpretation of these gas curves has resulted in the rearrangement of the gas detection equipment to furnish the operator with much improved data. The new method makes use of two complete gas detector bridges in obtaining the two gas curves. The gas-air mixture is circulated first across the detector of the first bridge with low voltage applied; the gas-air stream continues through the detector of the second gas bridge which has high voltage applied. The milliammeter readings of these two gas bridges are recorded.

The conventional method in general use has been to record the milliammeter reading observed when high voltage was applied to the detector filament, and then to reduce immediately the applied voltage of this single detector by operating a switch. This low voltage reading was then recorded. When the high and low voltage gas readings are obtained on two separate bridges, the data for indicating qualitative gas changes is very much better than that obtained by using the old conventional single detector system. In using two separate bridges each filament is balanced correctly; there is no need to apply a zero point correction which often drifts erratically when gas is present. Also there is a sudden reducing of voltage within a single detector chamber in which the amount of drop in heat is not known, since the gas-air mixture was already in a state of combustion at the time the voltage switch was made.

Figures 1 and 2 are gas logs obtained by using both methods. As indicated, the curves in the left gas column are those obtained by the new two bridge method while the curves in the right gas column are those obtained by the conventional method. It will be noted that the new method gives very much better results as indicated by the qualitative spreads in or above the top of the gas and oil pro-





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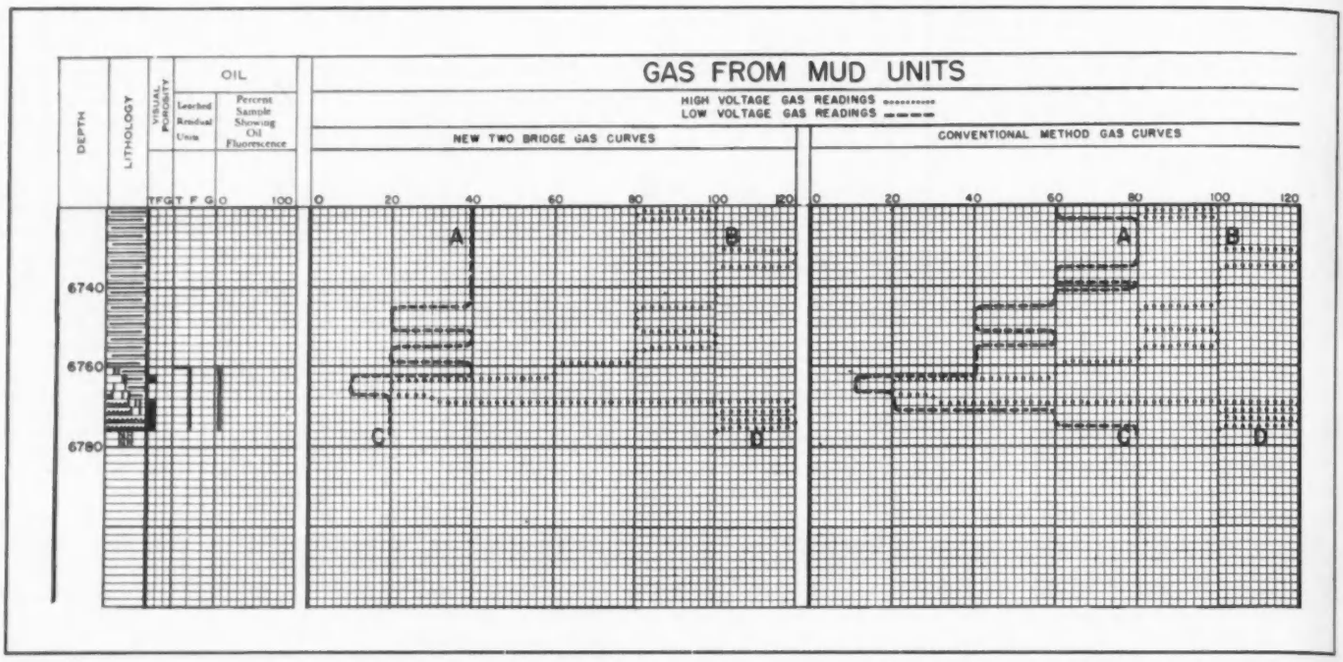

FIGURE 1—This is a discovery gas-distillate well in the Permian Basin. The shale section above 6760 feet was gas bearing. Returns from the tight limestone, which was topped at 6760 feet, showed a marked decrease in gas. When the chert was penetrated at 6768 feet the gas increased again. This gas increase alone could indicate that the chert was gas bearing; however, other factors, such as gas swabbed in during the trip to change the bit at 6766 feet, could easily account for the gas increase at 6768 feet. The one factor that does verify that this gas was from bottom is that the gas data recorded by the new two bridge system showed a qualitative change. The average spread between the low and high-voltage curves in the shale section is indicated as A-B, whereas the spread between these curves in the chert section is indicated as C-D. This qualitative gas change was not noticeable where the data was recorded by the conventional method.

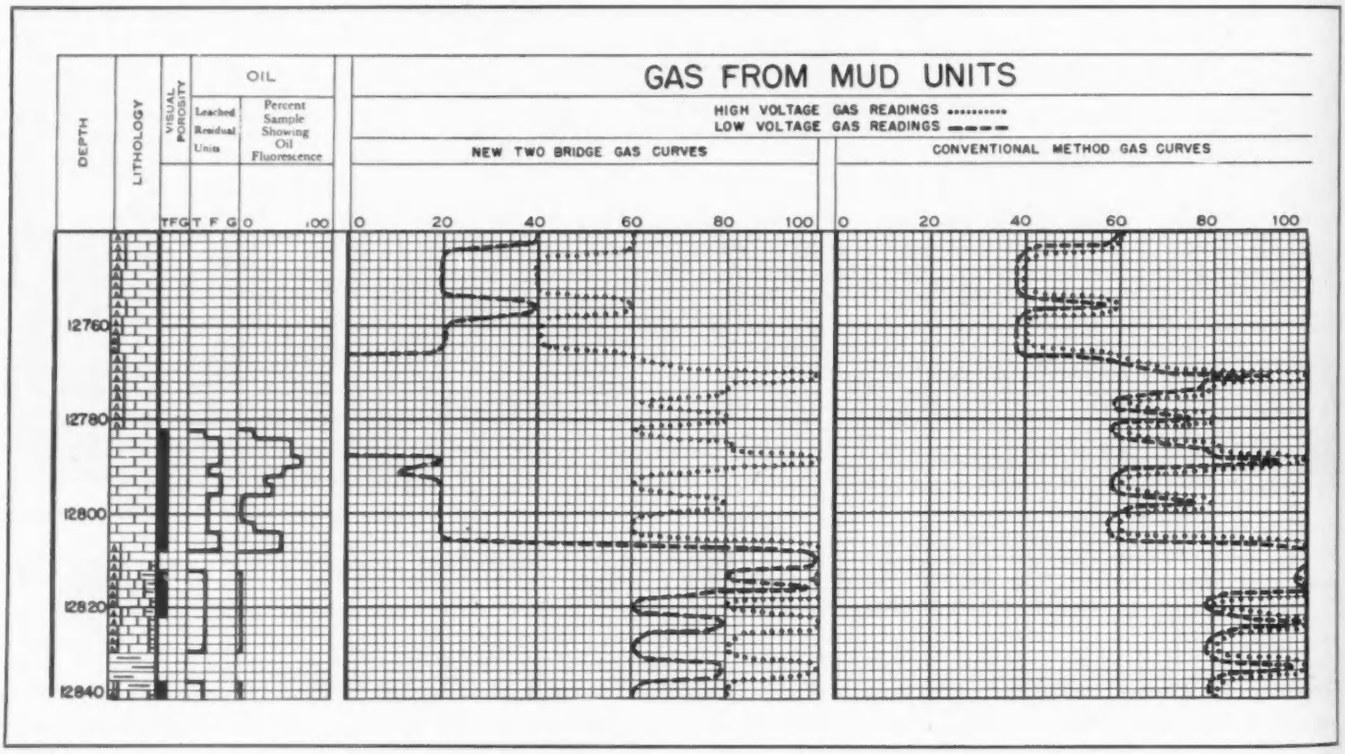

FIGURE 2—This is a discovery gas and oil producer from the Silurian limestone in West Texas. The gas cap in the top of this section is indicated by an excellent qualitative gas spread in the low and high voltage gas curves when the data was recorded from two separate bridges. This qualitative gas spread is not indicated by the curves plotted from data recorded by using the conventional one-bridge system.

ducing sections. An explanatory description will be found under Logs Figures 1 and 2.

Although the lack of a qualitative gas change does not condemn any gas show, a qualitative gas change, as indicated by a change in the ratios of the low to high voltage gas curves, is often encountered just above or in the top of a productive zone. Of course the change in quality does not necessarily indicate a producing section. There may not be sufficient porosity, permeability, or bottom hole pressure for production. *The qualitative gas change indicates that a new gas bearing formation has been penetrated by the bit, and if the lithology and other conditions are favorable, the section should be tested for production.*

—The End.

How to Select and Use Rotary Drilling Fluids

Continuing a discussion of the factors affecting the maintenance of rotary drilling fluids.

By EARL E. HUEBOTTER, Baroid Sales Division, National Lead Company, Tulsa
T. H. DUNN, Stanolind Oil and Gas Company, Tulsa, and
FRANK S. BELL, Shell Oil Company, Wichita Falls, Texas

Types of drilling fluids. The selection of the proper type of drilling fluid, with the correct properties, to drill a well is of prime importance. Such selection should take into consideration the quality and quantity of make-up water and materials available to prepare and maintain the drilling fluid; technical service available; composition, structure and arrangements of formation to be penetrated; equipment available to prepare, handle, and maintain the drilling fluids; drilling practices to be employed in drilling the well; casing programs; etc.

Even in the case of wildcat wells, considerable knowledge is usually available as to the geological formations and structures likely to be encountered. It is generally possible, by working with expert geologic and petroleum engineering personnel and by analyzing problems encountered in wells nearest to the location, to properly plan a casing and mud program for the particular well.

Usually considerable expense can be saved by adopting a drilling fluid program patterned after the recommendations of a drilling fluids engineer having had considerable experience in the area or who has had access to drilling fluid records from offset or area wells. As mentioned previously, discussion of the proper mud programs for various conditions is beyond the scope of this paper, but all carefully planned drilling fluid programs will include the use of one or more drilling fluids from the list shown in Figure 10.

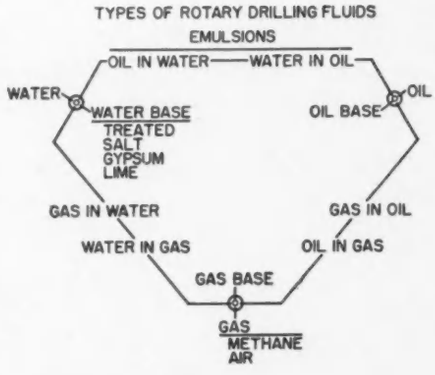

FIGURE 10

Water-base drilling fluids comprise the major portion of all drilling fluids in use today. Treated native muds account for the predominant portion of these water base drilling fluids and consist of water in which are suspended the native solids from the formations penetrated. Contaminations are usually held to a minimum, and those of calcium and magnesium salts are removed or converted to their sodium salts in which form they are less detrimental.

PART 2

Viscosities and gel strengths are reduced with thinners. Viscosities are increased with treated clays or bentonites. When filter losses are desired at lower levels than those obtained with native solids, treated clays, bentonites or organic filter loss reducing agents are added. Density is reduced by water dilution and increased with accumulated native solids and/or densifiers.

The cost of these drilling fluids starts at the cost of the water used to compound them and at times reaches $18 per barrel when extremely high densities are required.

Salt, gypsum, and lime drilling fluids are usually treated native mud containing sufficient quantities of the chemical in question so that they will resist further contaminations of the chemical in relatively large quantities. Attapulgite is substituted for bentonite to build viscosity in most of these drilling fluids and organic filter loss reducing agents must be used almost exclusively.

Oil-base drilling fluids consist of oil in which are dispersed materials quite different from those used in water base drilling fluids for raising viscosity and gel strengths, and lowering filter loss. These drilling fluids are relatively expensive, their cost starting at about $7 per barrel and ranging as high as $25 per barrel when extremely densified. Their use has been limited to drilling in or drilling predominately hard rock formations after casing has been set through the surface shale formations.

Emulsion drilling fluids are either of the water-in-oil base drilling fluid type, about which comparatively little has been published, or of the oil-in-water base drilling fluid type, which has become quite popular during the past five years. The unit cost of water-in-oil base drilling fluid emulsions reportedly will be less than the oil-base drilling fluid from which they are compounded; whereas, that of oil-in-water base drilling fluid emulsions is about the same or slightly more than the water base drilling fluid from which they are compounded.

Gas base drilling fluids consist of a gas, e.g., air, methane, etc., in which are suspended the materials being drilled and eroded or entering from exposed formations.

Drilling fluids intermediate between water or oil base and gas base are of

the gas-in-water or oil type which are generally known as "gas-cut" drilling fluids, or of the water or oil-in-gas type about which comparatively little has yet been published.

Properties of drilling fluids. The cost of any drilling fluid, regardless of type, depends to the greatest extent upon the physical properties desired in it. Listed in Figure 11 are the principal properties usually controlled in drilling fluids.

Density. The density of drilling fluids should be carried as high as practicable resulting from native solids for most economical maintenance costs. Fifty percent more water is required to compound and maintain a water-base drilling fluid with native solids at 9.8 pounds per gallon than at 10.5 pounds per gallon and twice as much water is required to compound and maintain the density at 9.5 pounds per gallon instead of 10.5 pounds per gallon.

Usually the unit costs of these drilling fluids will be comparable, hence mud costs can be reduced materially by carrying the higher densities with native solids; sometimes they can be cut in half. Loss of circulation problems frequently can be handled as economically with the higher density drilling fluids as with the lower density drilling fluids by using the normally produced excess drilling fluid to take care of losses to the hole with the possible use of some formation sealing agents.

The advantages of lower costs and smaller water consumption realized with the use of denser drilling fluids containing higher native solids contents frequently outweigh that of increased drilling rate resulting from the use of drilling fluids of less density.

Viscosity. The viscosity of a drilling fluid should be carried as low as permissible, using chemical thinners, if necessary, to assure minimum pump pressures to circulate the drilling fluid at a given capacity and obtain maximum drilling rates. The ability of drilling fluids to remove cuttings and cavings from bore holes calls for the annular velocity of the drilling fluid at all points in the bore hole to exceed the slip velocity of the cuttings and cavings in the flowing drilling fluid.

All steps should be taken to keep the bore hole as close to bit gauge as long as possible so that minimum viscosity, lower unit cost drilling fluids, can be used to realize maximum drilling rates.

Figure 11
PRINCIPAL PROPERTIES OF ROTARY DRILLING FLUIDS

- Density
- Viscosity
- Gel Strengths
- Filter Loss
- pH
- Chemical Composition of Solution Phase

Gel strengths. Of particular importance are the gel strengths of drilling fluids. Low initial gel strengths are important when the efficient settling of sand and silt and the escape of entrained air and gas are required. Recycling sand and silt through the hole not only increases wear of pump liners, bit, etc., but increases the "dispersement" of additional native solids in the drilling fluid, resulting in increased water consumption and material used to maintain the density and other properties of the drilling fluid, thus increasing drilling fluid costs.

Except in special cases, ten minute gel strengths of 10 to 20 grams are suitable in that they are relatively economical to obtain, are low enough to minimize swabbing on trips, retard channel flow of drilling fluids (if initial gel strength is low) through hole enlargements and pits, and are high enough to retard the settling of densifiers in the pits and the formation of fill at the bottom of the hole after trips. Gel strengths after one to three hours of quiescence should not exceed 40 to 60 grams so that circulation can be restored after trips without danger of lost circulation with the high pump pressures that would be required to circulate high gel muds.

High gel strengths after 1 to 3 hours of quiescence also promote swabbing of upper zones leading to gas entrainment and possible blowouts and contamination of the drilling fluids. The unit cost of treated native muds mounts rapidly when progressively lower gel strengths are desired, especially as contamination of the drilling fluid increases. All steps should be taken to hold contamination to a minimum and to relax specifications for low gel strengths as much as possible to retain unit drilling fluids costs at lower levels.

Filter loss. Generally lower filter losses reduce the swelling and dispersement of shale cuttings and cavings, reducing their entrainment as native solids in drilling fluids and thus reducing the quantity of drilling fluid produced from this cause and the resultant cost of treatments. Possibly more important is the fact that lower filter losses reduce the rate at which the shales drilled are wetted, penetrated, and softened with filtrate reducing their tendency to slough and cave or to be worn away rapidly by drill pipe erosion to form bore hole enlargements.

Higher filter losses result in tight places in the hole, which stick the drill pipe as well as result in excessive loss of water to porous formation. The cost of filter loss reduction depends upon the quality of native solids penetrated, the lack of contaminants in the drilling fluid, the type of treatment used, and the extent to which filter loss is lowered.

Having once obtained a given filter loss after normal treatment, treating costs mount rapidly as attainment of lower filter losses are attempted. Treating costs, as shown by Figure 12, increased from

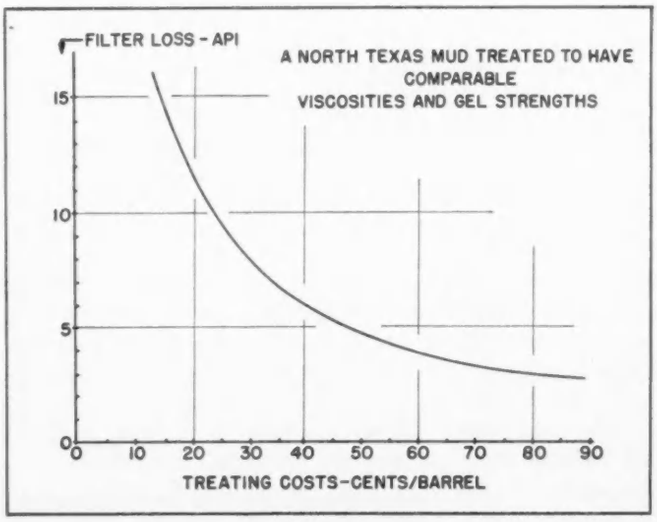

FIGURE 12

JUST as a baby's yell tells you that it's time for a change, the Wear Gage on the Mission Piston tells you when it's time to change the Piston. This Wear Gage, an exclusive patented feature with Mission, tells you when the flange is worn and that it is time to change the Piston Body. Combined with the replaceable rubbers, this Wear Gage assures you maximum, economical life for your Piston Rubbers and protection for your liners. Like every other Mission product this carries the famous Mission guarantee of complete satisfaction.

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20 to 40 cents per barrel in reducing the API filter loss of a mud from 12 to 6, and to 80 cents per barrel at an API filter loss of 3, the practical lower limit of the treatment in use. This curve illustrates that in certain higher ranges of filter loss, the cost of reducing filter loss a unit amount is relatively small and tends to be overshadowed by other drilling costs; whereas, the cost of reducing filter losses in lower than normal ranges is appreciable, and serious consideration should first be given to benefits to be derived from filter losses lower than normally attained before undertaking the additional treatment which will increase drilling fluid costs.

The selection of an optimum filter loss is further complicated by the tendency of lower filter losses to reduce penetration rates. In general, selection of filter loss must be based upon past drilling experience in the immediate area, studying such overall factors as total drilling cost, major drilling difficulties, productivity indices and drilling mud costs.

Good records of the foregoing factors make it possible to steadily improve the mud program and to lower mud costs as low as permissible with the over-all goal of low drilling costs and unimpaired productive formations.

The pH of drilling fluids should be maintained as low as practical to avoid structural alteration of the bentonite, clay and suspended native shale solids in the drilling fluid when this problem exists and keep treating costs to a minimum. Normally a pH of from 9 to 10 is satisfactory for most treated native muds, and is increased to from 10 to 11 when heavier caustic soda-thinner treatments are necessary for lower gel strengths, concentrating bentonite for lower filter losses or removal of magnesium ions as a contaminant is desired.

Native muds treated with caustic soda-thinner mixtures to resist heavy contamination, will have pH values between 11 and 12. Lime or high pH starch drilling fluids will have pH values above 12.

Chemical composition of the solution phase. The chemical composition of the solution phase of drilling fluids determines to a great extent their unit cost. The higher the concentration of chemicals in the solution phase of the drilling fluid, the higher its unit cost. If the composition of the solution phase is controlled to possibly reduce any detrimental effects on producing formations caused by water filtrates considerable expense can be saved by confining such control to the drilling-in period.

Drilling practice. Maintenance of drilling fluids depends greatly upon the drilling practices in force. It is very important that sufficient drill collars be used in drilling. If only one drill collar is used in the drilling string, then generally the string buckles into a spiral that bears against the walls of the bore hole as shown in Figure 13 causing the grinding of cutting sand cavings and their entrainment into the drilling fluid.

If the formations opposite the zones of bearing are soft, such as shales, they are subjected to the grinding force of the spiraled drilling string and are worn away resulting in hole enlargements. The rate of abrasion of such formations is influenced by the type of shale, the filter loss of the drilling fluid which permits the wetting and softening of the formations, the drilling rate, speed of rotation, and the force with which the drilling string bears against the formation.

As the weight on the bit is increased, the spiral as shown in Figure 13 becomes longer and the force with which it bears on the wall of the hole increases; consequently, the above phenomenon becomes more detrimental.

Entrainment of native shale solids normally amounts to from 5000 pounds to as high as 150,000 pounds in a day's drilling, requiring from 4 to 1230 barrels of water per day to maintain a 9.8 pounds per gallon treated native mud. A considerable portion of this entrainment can be accounted for as resulting from the grinding action between the drilling string and the wall of the bore hole and a small portion from the grinding action of the bit.

In extreme cases the maintenance of drilling fluids can be increased thirtyfold by carrying excessive weight on the bit with too limber a drilling string above the bit.

Drill collars. Substituting drill collars for drill pipe above the bit, to provide the weight on the bit, will minimize abrasion of the bore hole and grinding of cuttings and cavings in that there is no helical buckling. Under these conditions the entire drilling string will lay along the low side of the hole, except for a portion of about two drill collars above the bit as shown in Figure 13. The forces with which the drill collars act on the wall of the hole increase with hole inclination, but by proper choice of the number and size of drill collars, hole inclination can be maintained small to achieve drilling conditions that will avoid serious hole enlargement.

Under comparable conditions, the substitution for drill collars for drill pipe above the bit, to provide all the weight carried on the bit, will reduce the amount of native shale solids ground into the drilling fluid from the shale formations penetrated, will reduce the amount of water and materials required to maintain the drilling fluid, and thus will reduce drilling fluid costs.

The use of oversize instead of conventional size drill collars above the bit is recommended only to the extent that it is necessary to help drill a more vertical hole because as the outside diameter of the drilling string ap-

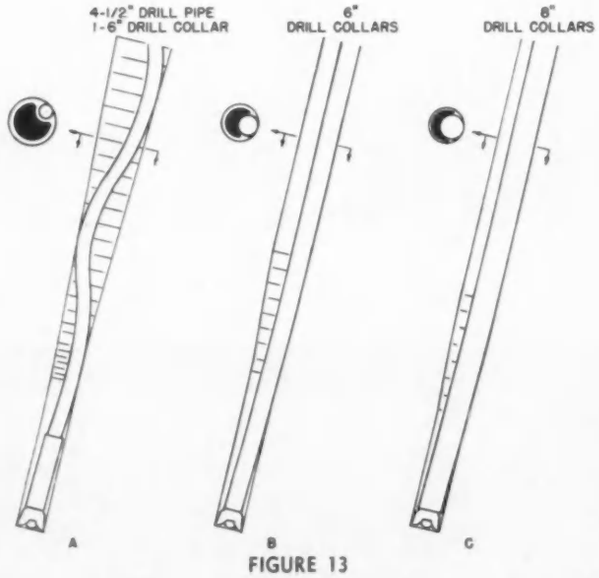

FIGURE 13

ROTARY DRILLING LINES really take a beating on today's high speed, deep-digging rigs. They have to be strong, tough, and flexible; yet resist crushing and abrasion. For top performance on this job, just any rope won't do. You need the best—and you get the best when you specify Edwards Wire Rope.

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proaches the size of the bore hole drilled, the shale formations penetrated may be eroded away excessively by the increased rate of flow of the drilling fluid in the restricted annulus as shown in Figure 13. In this respect it has been observed in cases that the maintenance of a drilling fluid in a well where a 7⅞-inch hole is being drilled with a 4½-inch outside diameter drill pipe is greater than when drilling an 8¾-inch hole with the same size drill pipe.

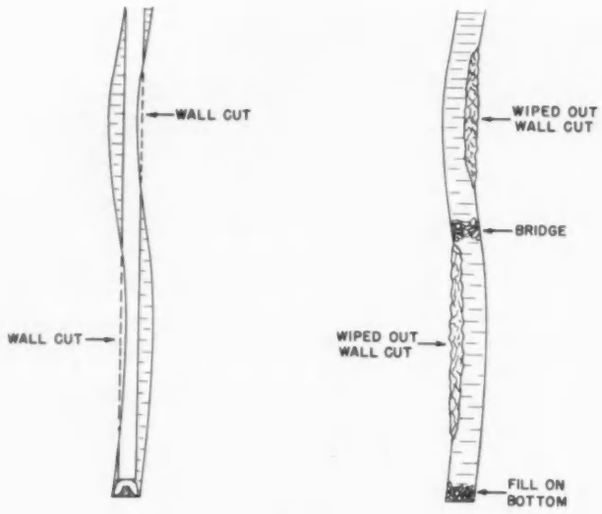

FIGURE 14

Wall cutting. Wall cutting is also a serious factor in the maintenance of drilling fluids in that frequently when they are wiped out on trips, large quantities of shale forming these cuts are torn loose and dumped into the bore hole producing bridges at constricted or ingage points or fill at the bottom of the hole as shown in Figure 14.

Usually this debris must be pulverized to be circulated out of the well, resulting in a great portion of it becoming entrained in the drilling fluid and thus requiring extra water and materials and increasing drilling fluid costs. These wiped out wall cuts also produce hole enlargements, necessitating higher viscosity and higher unit cost drilling fluids to circulate cuttings and cavings up through them.

Keeping hole full on trips. Another important factor in the maintenance of drilling fluids is keeping the hole full on trips. Frequently exposed salt water sands below the surface pipe will unload salt water; and possibly loose, water-soaked formations will slough and cave into the bore hole when exposed if the hole is not kept full of drilling fluid when withdrawing drill pipe.

The salt water increases the salt content of the drilling fluid, necessitating the maintenance of a higher unit cost drilling fluid to obtain the same desired properties. Hole enlargements are produced by the sloughed and caved formations, resulting in higher unit cost mud to circulate cuttings and cavings up through the hole enlargements.

Excessive rates of withdrawal and placement of the drilling string. Careful attention must be paid in making trips to assure minimum maintenance costs of the drilling fluids. Excessively fast withdrawal of the drilling string tends to swab in salt water and wipe out any well cuts producing hole enlargements which necessitate heavier treatments to overcome the salt contamination and result in higher unit cost drilling fluids.

Better quality drilling fluids are required to circulate cuttings and cavings up through the hole enlargements. Excessive rates of placement of drill pipe and spudding tend to break down formations, creating loss of circulation problems which cause increased drilling fluid costs. Elimination of a float in the drilling string will tend to reduce its plunger effect when going into the hole, reducing the possibility of breaking the formation down.

Also in this respect, when using high gel strength muds, to break circulation several times while going into the hole may prevent loss of circulation due to excessive pump pressures required to obtain circulation.

Annular velocity. Maintaining adequate annular velocity of the drilling fluid in the bore hole to circulate out cuttings and cavings is very necessary to assure minimum drilling fluid maintenance cost. When annular velocities drop too low to effectively remove cuttings and cavings, for example in hole enlargements, either the viscosity must be increased to increase the lifting power of the drilling fluid (which increases its unit cost) or the cuttings and cavings will have to be pulverized by the rotating drilling string so they can be removed with the existing drilling fluid at the prevailing annular velocity.

Of course, the latter procedure produces excessive entrainment of native shale solids in the drilling fluid, requiring extra water and materials to make them into drilling mud. Having sufficient pump capacity on a rig to adequately circulate drilling fluid can materially reduce drilling fluid maintenance cost.

In this respect it has also been found that the usual practice of raising the viscosity prior to running an electric log or taking a drill stem test can be eliminated if normal or increased circulation and normal pipe rotation is maintained up to the time the drill pipe is withdrawn.

Conclusions

1. The information compiled by this committee indicates that some of the major factors affecting the maintenance of rotary drilling fluids fall into the following classifications: (1) compounding, mixing, and handling operations; (2) program of sampling, testing and making recommendations; (3) specified drilling fluid types and properties; and (4) drilling practices.
2. Drilling fluid costs can be reduced by using better drilling practices, e.g., use of drill collars to avoid buckling of the drilling string; by using better mixing and handling operations; and by specifying drilling fluid properties, such as density, viscosity and filter loss, which fall within moderate cost ranges.
3. Several opposing factors must generally be considered and balanced to arrive at the best rotary drilling fluid maintenance programs consistent of achieving low drilling costs.
4. Close cooperation is necessary between the operator, drilling contractor, supplier and engineer to secure the best drilling and maintenance program.

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An acknowledgment and reference list appeared with Part I of this article.

—The End

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More Efficient Rig Hydraulic System Means More Profit in Shallow Drilling

Here are some handy hints on how to minimize (1) friction loss through the drill stem, (2) pressure drop across the bit nozzle, (3) friction loss due to fluid return through annulus, and (4) friction loss through surface connections.

By JOHN CASSIDY, JR., Cyclone Drilling Company, Tulsa

IN CONTRACT DRILLING, one of the main factors limiting performance is the hydraulic efficiency of the rig. The principal elements that make up the total pressure loss in the rotary drilling rig circulating system are as follows:

- Friction loss through the drill stem
- Pressure drop across the bit nozzle
- Friction loss due to the fluid return through the annulus
- Friction loss through the surface connections.

Friction loss through drill stem. Friction loss through the drill stem is a loss that can be controlled by the contractor. Friction loss is so high on 3½-inch drill pipe that a contractor should not attempt to drill with it except when physical conditions are such that nothing else will do.* For this reason, let us assume the use of 4½-inch drill pipe. Where practical, 4½-inch drill pipe with full-hole or extra-hole tool joints should be used. This leaves only the drill collars in the drill string to be reckoned with.

The bore of drill collars has been overlooked since the advent of long strings of small-bore drill collars in West Texas. When they first came into use, 80 percent of the long strings of drill collars made were used in West Texas, where the contractors were more interested in the extra weight than in a high circulating volume. As long as the penetration rate was slow, it took very little fluid to lift the cuttings. However, in the rest of the country where high circulating volumes were needed in addition to weight, the trend seemed to go to

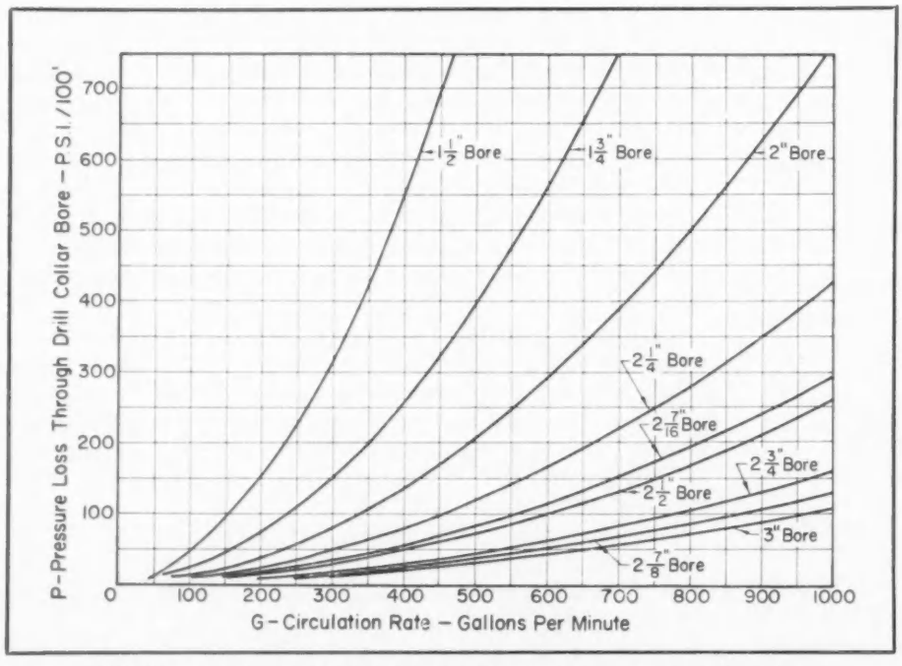


FIGURE 1—Friction losses through bore of drill collars vs. circulation rate.

NOTE:

These curves based on the following formula

$$P = \frac{.058\ G^{1.86}}{D^{4.86}}$$

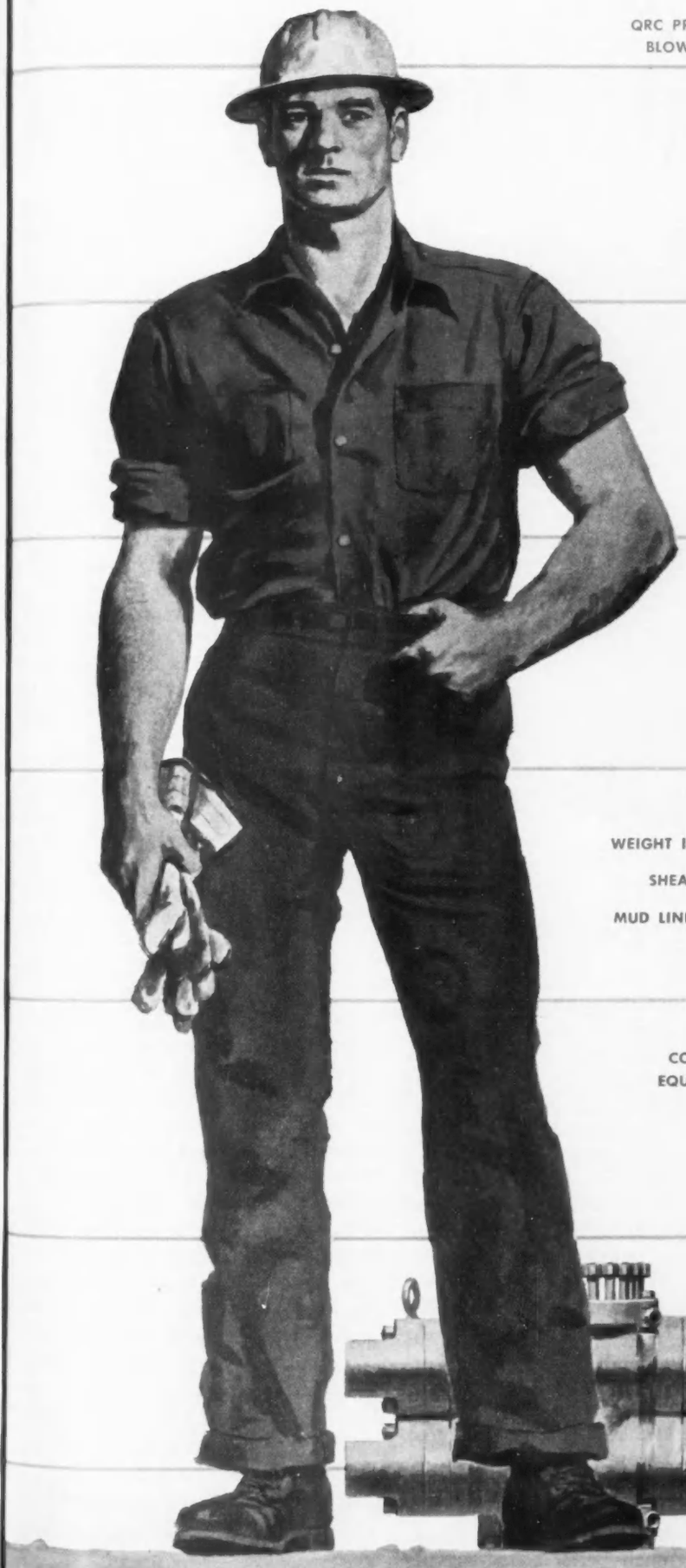
WHERE:

P = Pressure Loss Through Drill Collar Bore in PSI/100 feet
G = Circulation Rate in Gallons per minute
D = Drill Collar Bore Diameter in Inches

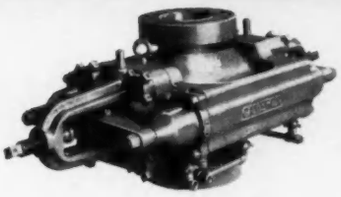
ASSUMING:

Mud Weight = 9.5 Lbs./Gal.
Mud Viscosity = 3 Centipoises

* Editor's Note: The author is assuming conventional hole sizes. Slim hole drillers will find a proportionate reduction in pressure loss using 3½-inch pipe instead of 2⅞-inch, as the author found using 4½-inch instead of 3½-inch pipe.



QRC PRESSURE OPERATED
BLOWOUT PREVENTERS



SS PRESSURE OPERATED
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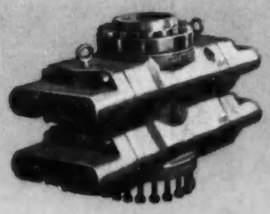
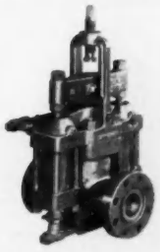


HCR PRESSURE OPERATED
FLOWLINE GATE VALVES

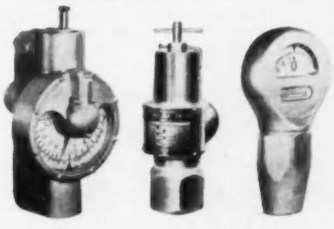


FLEX-SEAL MUD VALVES

WEIGHT INDICATORS

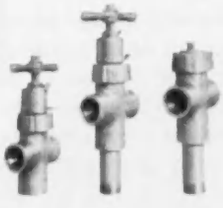
SHEAR RELIEF VALVES

MUD LINE PRESSURE GAUGES



COMPLETE WELL HEAD
EQUIPMENT AND VALVES

PRODUCTION CHOKES



SAFETY XMAS TREES

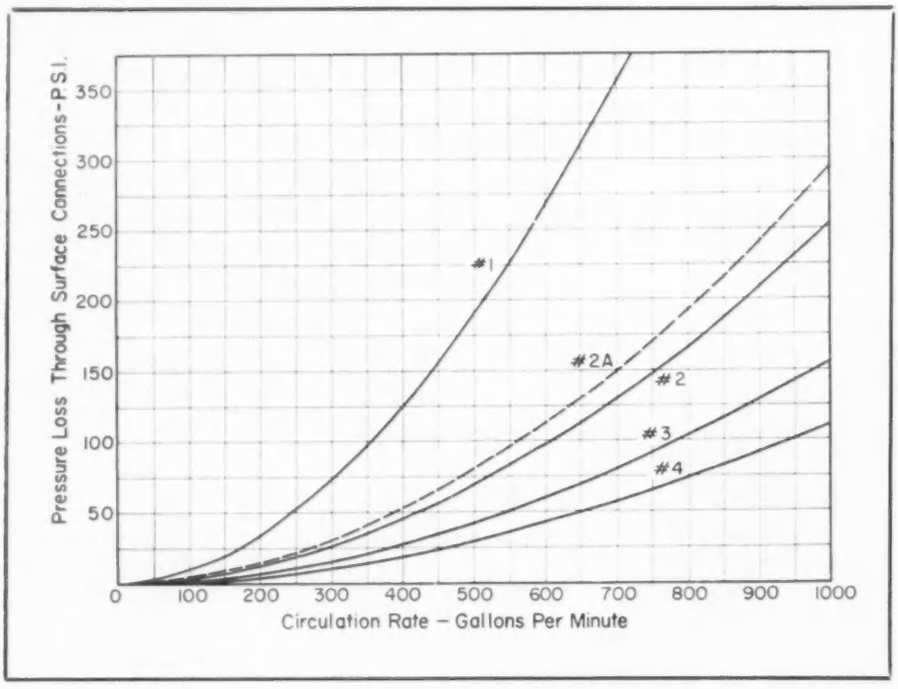


FIGURE 2—Friction losses through various combinations of surface connections found on rotary rigs.

Surface Connection Combinations

COMPONENT	No. 1		No. 2*		No. 3†		No. 4†	
	I.D.	Length	I.D.	Length	I.D.	Length	I.D.	Length
Standpipe	3"	40'	3½"	40'	4"	45'	4"	45'
Hose	2"	45'	2½"	55'	3"	55'	3"	55'
Swivel Washpipe and Gooseneck	2"	4'	2½"	5'	2½"	5'	3"	6'
Kelly	2¼"	40'	3¼"	40'	3¼"	40'	4"	40'

* Use Curve No. 2A instead of Curve No. 2 when substituting 7 joints of flexible-coupled 3" pipe (total 55') for 55'.
† Curves No. 3 and No. 4 may be used as shown when substituting 7 joints of flexible couples 4" pipe (total 55') of 3" I.D. Hose.

small-bore drill collars because most collars available were small-bore collars. In shallow drilling, weight is very beneficial only when there is sufficient circulation to keep the bit clean. Instead of the 2¼-inch bore used in the multi-collar strings on deep wells in West Texas, shallow strings should be bored to at least 2¾ inches, and preferably 2⅞ inches. Note the differences in friction loss per 100 feet as shown on (Figure 1) for the various bores.

Pressure drop across bit nozzle. Pressure drop across the bit is something the contractor can do very little about. It is predetermined by the bit manufacturer and can be controlled only by the contractor's selection of bits.

Friction loss due to fluid return through annulus. In contract drilling, this loss is very small compared to other losses, so that increased friction loss caused by large drill pipe is negligible.

Friction loss through surface connections. Friction loss through surface connections and friction loss in the drill stem are the two elements where the contractor himself can do the most to increase hydraulic efficiency. All steel mud lines, including standpipe, should be 4-inch lines. Many shallow rigs are split rigs, and because of this, it should be easy to rig them up without ells and swings. The only ell required is the ell used in connecting the standpipe to the mud line. This should be a long-sweep ell. For this setup, the pump could be set behind the rig, perhaps perpendicular to the rig, and the discharge should be located so that there are no sharp bends from pump discharge to mud line, which should run straight to the standpipe. This set-up necessitates the use of a short vibrating hose, but it is much better than carrying three or four ells in the mud line. Rig-ups are now operating that carry many extra ells in the mud lines, as well as having mud lines swedged down. The pump should also have a large suction free of leaks and no longer than necessary. A small-diameter suction makes for easy rig-ups but will always give low efficiency and poor performance.

Another piece of surface equipment that will add considerably to efficient drilling is the rotary hose. Some contractors use the 2½-inch inside diameter hose for shallow drilling (4000 feet). Small I. D. hose has been found by the writer to be inefficient and uneconomical because of higher friction loss and because of increased vibration. Especially is this true when coming from a 4-inch mud line to a 2½-inch I. D. hose. This reduction gives a jetting action and will cause the hose to vibrate against the derrick leg, or other obstructions, causing exterior damage to the hose.

If rigged up correctly, the lower circulating pressures of shallow strings enable a much higher circulating volume since they are not slowed down by restrictions such as the small diameter of the rotary hose. One of the main arguments for the small I. D. hose has been the mistaken idea that there is no point in having a hose with a larger diameter than that of the swivel wash pipe. This is a misconception that should be corrected. The friction loss through a restriction such as the swivel wash pipe depends upon two factors: (1) streamlined flow and (2) length of the restriction.

Shallow rigs work with much lower pressures than long strings, but their circulating volume is probably just as high. Since friction loss is a function of velocity and not of pressure, it is just as important that the surface connections be free of restrictions on a shallow rig as on a deep rig.

Percentage-wise, it is much more important that a shallow rig have free and open connections than a deep rig. For example, if a shallow rig and a deep rig both were equipped with 3½-inch mud lines, 2½-inch hoses, 2½-inch swivel wash pipe, and a 3¼-inch kelly with a circulating rate of 350 gallons per minute, the pressure loss would be 100 pounds.

If the same system were used with a 4-inch standpipe, 3-inch hose, 2½-

Continued on Page 228

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Perforating Plastic Pipe . . . What Gun Should Be Used?

Here are some answers based on seven tests using both shaped charge and bullets.

By D. S. McKEE, Lane-Wells Company, Oklahoma City

THERE HAS BEEN a growing interest in the use of plastic materials as substitutes for steel in several oil well applications. Since such plastics may be used, under certain conditions, as casing or liners for cementing through a productive zone and then perforating for production, tests were run to indicate the effects that both bullet perforating and shaped charge perforating would have on the plastic material. The tests were made at the company's plant in Oklahoma City, using fibrous plastic pipe, both supported and unsupported. The former were supported in 15-gallon drums with a 15.5-pound neat cement slurry.

The equipment used in making the tests was as follows:

1. One two-shot section 2⅛ inch B-C gun loaded with bullets.
2. Three eight-shot 2⅝ inch shaped-charge guns loaded as follows:
   a. Two guns loaded with four shots to cover one foot.
   b. One gun loaded with one shot.
3. One 25-shot 3¼ inch Type "E" gun with 25 3¼-inch barrels.
4. Two ten-shot 3⅛-inch shaped-charge guns loaded as follows:
   a. One gun loaded with four shots to cover one foot.
   b. One gun loaded with one shot.
5. Forty-five volt dry cell battery with 250 feet of rubber-insulated, two-conductor cable.
6. Gun tester and Type "D" cartridge tester.
7. One red and yellow chalk marker.
8. Five 15-gallon test drums made up as follows:

Quantity	2	3
Pipe Size	3½"	4½"
I.D.	2 15/16"	4 1/16"
Wall Thickness	11/32"	1/32"
Type	Tubing	Line Pipe
Length	2 ft.	2 ft.

9. One 3½-inch and one 4½-inch section of pipe having the same dimensions as listed above but used unsupported.

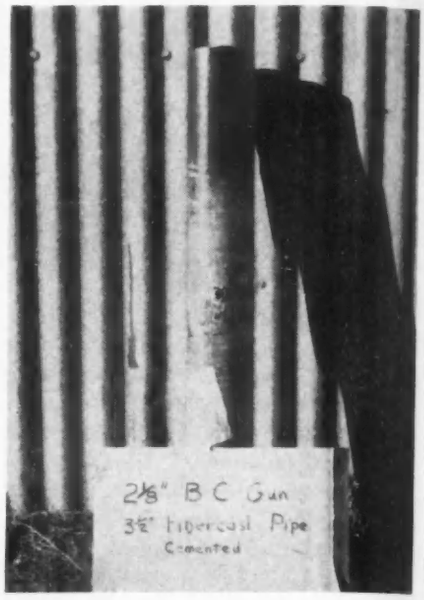

FIGURE 1

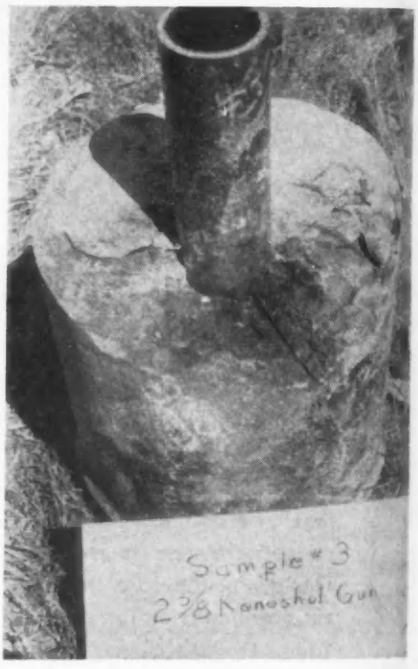

FIGURE 2

TEST 1

Two shots were fired selectively with 2⅛-inch B-C (bullet-type) gun into a sample consisting of 3½-inch tubing which was supported with neat cement. The results are shown in Table 1.

On the first shot there was one crack 2¼ inches long parallel to the axis of the pipe and another crack 3¾ inches long perpendicular to the axis of the pipe. Both cracks had their point of origin at the hole made by this shot. The cement was fractured badly around the hole.

The inside of the pipe was roughened by the recoil of the gun and the pipe was partially collapsed around the hole. A large piece of the outer layer of fibrous plastic pipe 2½ inches x 1⅝ inches, was peeled back.

The condition of the outside of the pipe and the characteristics of the hole can be seen in Figure 1.

On the second shot there were no cracks in the pipe around the hole and the cement was in good condition.

TEST 2

This test was made with the 2⅝-inch shaped-charge gun and four charges were fired simultaneously in a one-foot section into a sample which contained 3½-inch tubing supported with neat cement. The results are shown in Table 1.

From each of the first and second holes there were four cracks ¼-inch radially from the hole. From the third and fourth holes there were no cracks. The holes in the pipe were very small as can be seen in Figure 2. They were partially plugged by fibers from the pipe.

Continued on Page 225

Continued From Page 222

TEST 3

This test was made with the 3⅛-inch shaped-charge gun and four shots were fired simultaneously in a one-foot section into a sample consisting of 4½-inch line pipe cemented in the 15-gallon drum. The results are shown in Table 1.

Hole No. 1 had no cracks.

Hole No. 2 had three ¼-inch cracks running radially away from the hole.

Hole No. 3 had one crack 3 inches long parallel to the axis, with origin at the hole.

Hole No. 4 had one crack parallel to the axis of the pipe and running for 10 inches to the end of the pipe, as can be seen in Figure 3. This was probably caused by gun recoil. There were two other cracks 1¾-inches and 2-inches on opposite sides of the hole and perpendicular to the axis.

The cement was "belled out" around the holes and strands of fibrous plastic pipe were present all around each hole.

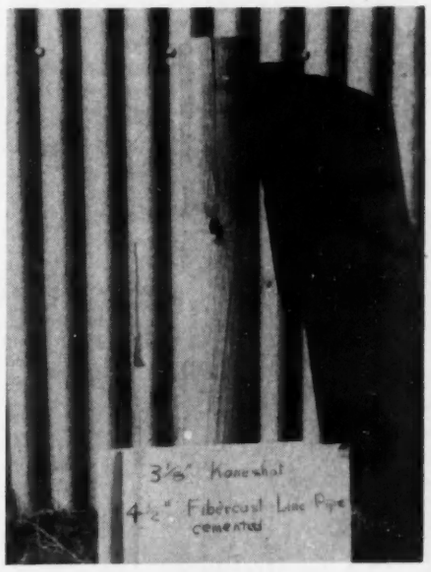

FIGURE 3

TEST 4

Three rounds were fired selectively from a 3¼-inch E (bullet-type) gun into a sample which consisted of 4½-inch line pipe supported in neat cement. In this test the gun was positioned so that all three shots were fired in the same side of the pipe at 2-inch spacing. Figures 4 and 5 show how this affected the drum and the cement. The results are shown in Table 1.

The extremely large entrance hole indicated by the picture was due to three shots on the same side of the pipe at 2-inch spacing. (Figure 6.) This was not considered a reasonable test since this pipe would probably never be shot using such close spacing.

There were two cracks in the pipe, one 1¾-inches parallel to the axis and one ½-inch perpendicular to the axis.

The cement was badly broken up

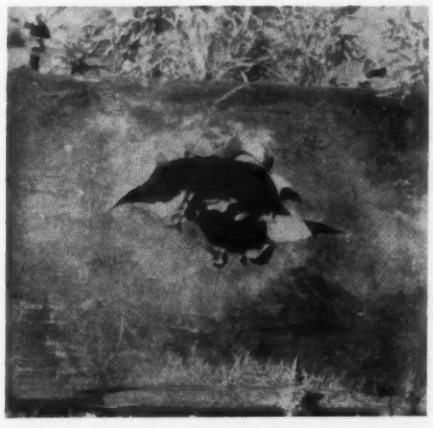

FIGURE 4

FIGURE 5

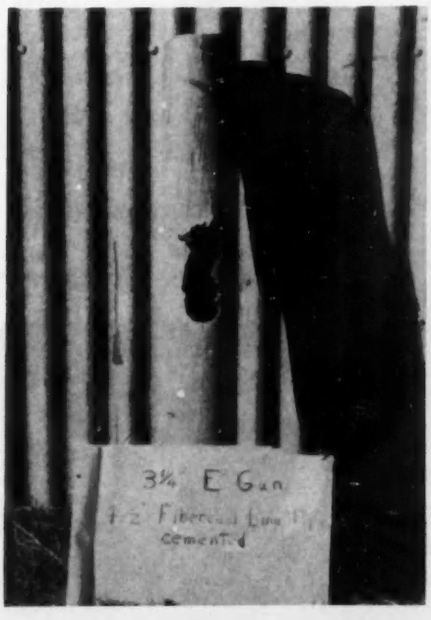

FIGURE 6

TABLE 1

Test No.	Sample No.	Pipe Size	Gun Size & Type	No. Shots	How Fired	Casing Supported or Unsupported	Entrance Hole Size
1.....	1	3½"	2⅛" B-C	2	Select.	Supported	No. 1¾" x 1¼" No. 2 15/32"
2.....	3	3½"	2⅝" K/S	4	Simul.	Supported	No. 1¼" Round No. 2¼" Round No. 3⅛" x ⅝" No. 4½" x ¼"
3.....	5	4½"	3⅛" K/S	4	Simul.	Supported	No. 1¾" Round No. 2¾" Round No. 3⅝" Round No. 4⅝" x ¾"
4.....	7	4½"	3¼" E	3	Select.	Supported	5¼" x 1¾"
5.....	6	4½"	3¼" E	2	Select.	Supported	No. 1-2" x 2⅜" No. 2-1⅝" x ¾"
6.....	9	4½"	3¼" E	1	.....	Unsupported	1¼" x 1 5/16"
7.....	10	3½"	2⅝" K/S	1	.....	Unsupported	½" Diameter

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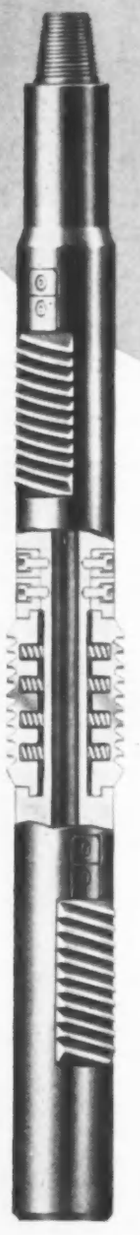

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and knocked out by the impact of the shots.

TEST 5

This test was made with the same equipment as Test 4 but with usual spacing, two shots being fired selectively into a sample which consisted of 4½-inch line pipe supported by neat cement. See Table 1 for the results.

With the first shot there was one 4½-inch crack parallel to the axis of the pipe, its origin being at the hole. See Figure 7.

With the second shot there was one ½-inch crack originating at the hole and running perpendicular to the axis of the pipe.

Two thin layers of fibrous plastic pulled loose from the outside of the pipe. One was approximately the size of the hole and the other twice the size of the hole.

TEST 6

In this test one shot was fired into unsupported 4½-inch line pipe with the 3¼-inch E gun (bullet-type). The results are shown in Table 1.

There were no cracks in the pipe and the hole was fairly uniform.

TEST 7

In this test one shot was fired into unsupported 3½-inch tubing with the 2⅝-inch shaped-charge gun. The results are pictured in Figure 8 and outlined in Table 1.

There were no cracks in the pipe. The hole was fairly regular, with a thin portion of the outer layer laid back $1\frac{1}{16}$-inch maximum. This appears to be a crack in the picture, but it does not go beyond the first layer.

SUMMARY

From the tests as briefly described, it appears that the bullet-type perforator is the gun that should be selected to shoot fibrous plastic pipe. This conclusion is based on the following:

1. In several instances the holes made in the pipe with the shaped-charge guns were partially plugged with fibers from the pipe. These holes probably will have a tendency to plug completely.

2. The holes made with the bullet-type gun were larger and more even.

3. Since the bullet-type gun is fired selectively, there will be less recoil damage to the pipe.

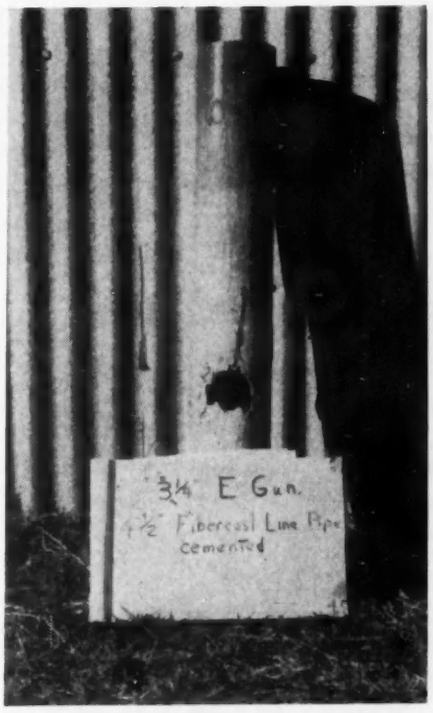

FIGURE 7

FIGURE 8

These tests also indicate that the maximum shot density should be 1 per 6 inches with a recommended shot density of 1½ per foot.

—The End.

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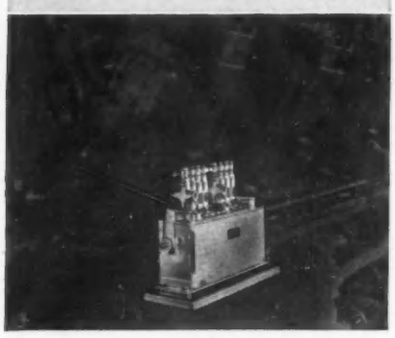

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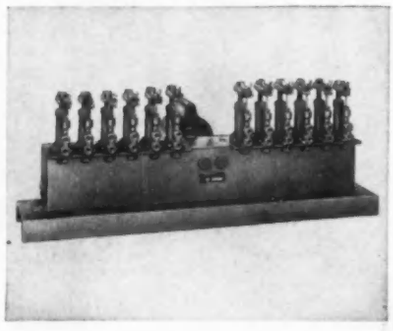

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Rig Hydraulic System

Continued from Page 220

inch swivel wash pipe and connections, and a 3¼-inch kelly, the pressure loss would be only approximately 19 pounds.

On a rig using 240 horsepower to circulate a string at 1000 pounds per square inch, only 10 percent of the output is being consumed in the surface connections. However, with the same system circulating the same volume with a shallow string at 500 pounds pressure, 20 percent of the total output is being consumed by the surface connections. This is assuming equal circulation rates. In many cases, for most efficient drilling, shallow strings need a higher circulating volume than long strings. (See Figure 2).

Many of the conditions mentioned set up a chain of inefficiencies that become very serious. For instance, if surface connections are poorly designed and high pressure losses result so that mud velocity is too slow to properly clean the hole, it then becomes necessary to increase the weight and velocity of the mud in order to clean the hole. But in doing this, the friction losses become even higher throughout the entire system. Although the mud can be conditioned to a point where it will clean the hole, the drilling characteristics of the mud are being sacrificed in order to keep the hole clean, and a low rate of penetration results. Had an effort been made to clean the hole with a higher circulating volume instead of working on the velocity, it might have been possible to have enjoyed several hundred more feet of fast drilling.

Drilling mud is, of course, essential; but in these days of highly competitive drilling, the contractor cannot afford to mud up simply because the hole is not cleaning up. Certainly he has to mud up as soon as the hole starts giving trouble, but not before.

In summary, the drilling contractor must give careful study, not only to getting a contract, but to the factors that will make that contract profitable. One of the most important of these factors is that of operating an efficient and properly engineered hydraulic system which will provide optimum efficiency. This factor is as important in shallow drilling as it is in deep drilling. **—The End**

ACKNOWLEDGEMENT

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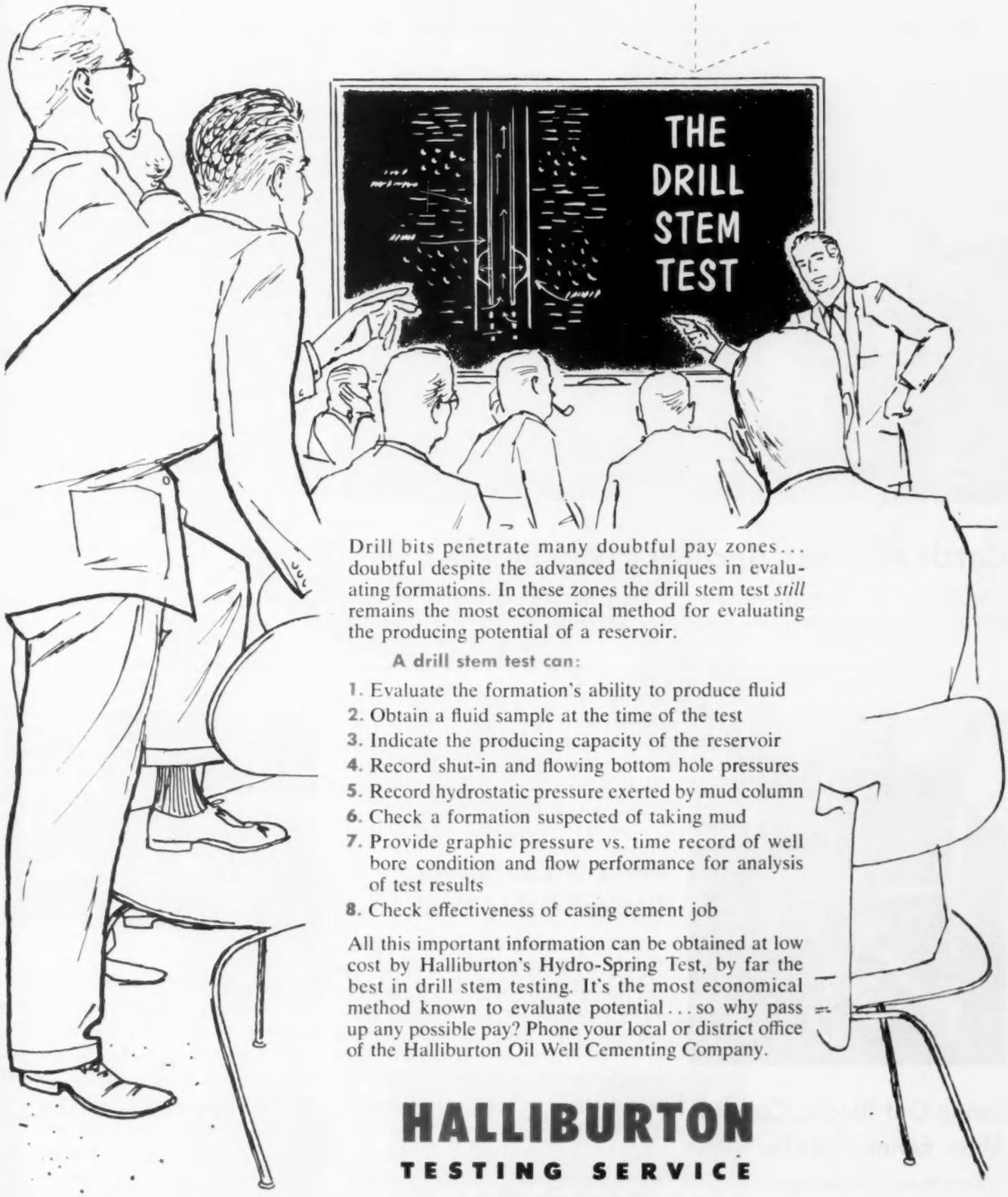

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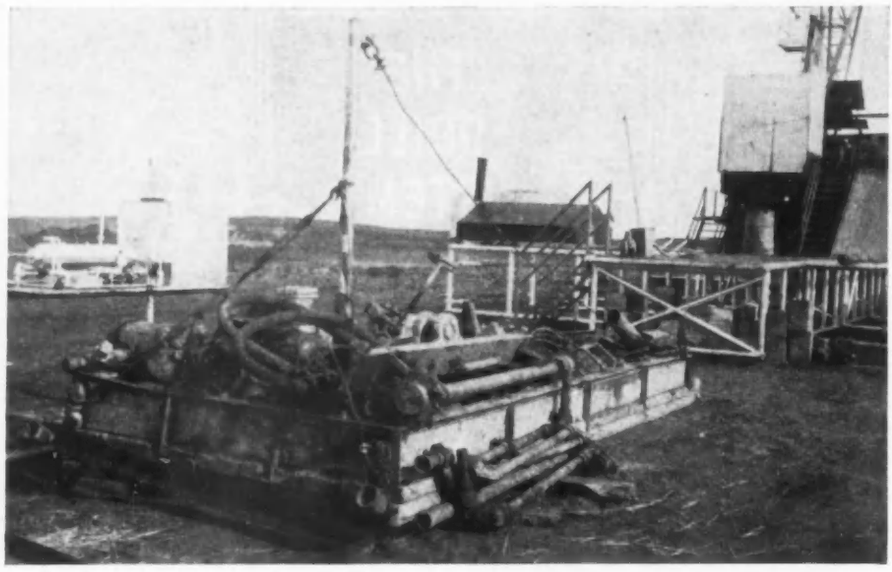


Catch-All Boat Anchors Highline Post

Mounting the highline back-up post a short distance away from the end of the walkway facilitates loading and unloading of trucks; the line can pass across the truck bed and leads can be handled and positioned more handily.

Anchor the highline post by mounting it on a large, truck-width skid-mounted boat in which all types of miscellaneous fittings and seldom-used or salvaged equipment can be kept. Position the post near the back end of the boat and adequately guy it with a pair of lines cinched down tightly with turnbuckles. The catch-all boat serves the dual purpose of anchoring the post and providing a centrally-located storage place for scrap material.

Besides providing a storage point that helps keep the lease and rig area clean, the boat permits easy recovery of a particular piece of equipment which can be quickly drawn up into the derrick with the highline.

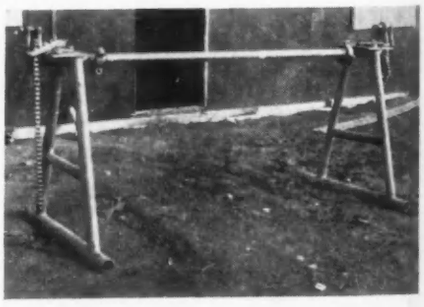
Position the boat so ample room remains between it and the end of the walkway.

Swing-Out Stools, Counter Make Eating Area for Crew

For the convenience of the men on the rig, one South Texas fireman constructed a special eating area consisting of two swing-out stools and a unique food counter. The seats, as shown, are mounted on inverted Figure 4 frames secured at the top by pivot mounts under the counter and at the bottom by another pivot mount nailed to the floor.

Portable Vise Speeds Rig Pipe Fitting Work

An improvement over the typical pipe vise stand used around the rig for miscellaneous pipe fitting work is to be found in the unit shown. Two, not one, pipe vises are used; one on each end of the two-legged rack. This permits anchoring both ends of a long piece of pipe or a difficultly-handled pipe assembly whenever extra effort must be exerted to make up or break out high pressure fittings. The dual vise also permits two men to work simultaneously on small fittings, one at either end of the unit, whenever necessary.



Use of two unions to tie the pipe rack ends together permits complete breaking down of the unit into easily carried and easily-racked pieces and permits rapid installation of a longer or shorter spacer bar (2-inch pipe) to adapt the unit to a particular job. The longer base members, made of 2½-inch pipe, provide extra stability which allows workmen to use more leverage without fear of tipping the unit whenever difficult pipe make-up jobs are being handled.

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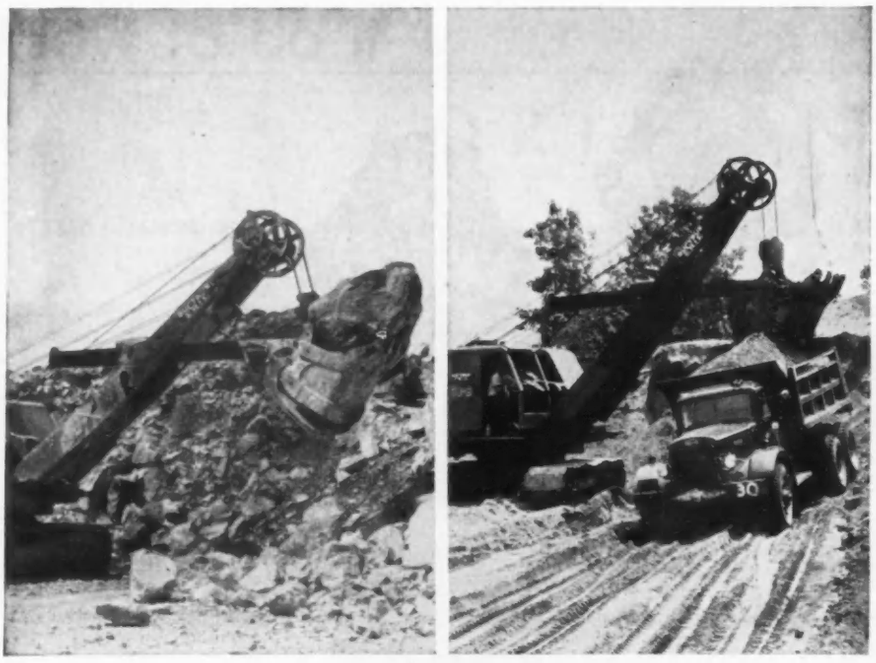

Same equipment—different jobs

Should you change wire rope constructions?

Under normal conditions there is one best size and type of rope for every wire rope using machine. This is the one you use day in and day out on routine work. But what about other conditions, the tough job, the unusual job? Suppose abrasion becomes a bigger factor, or unusual strength is needed, or more flexibility? Is a change of rope type in order?

Take a power shovel, for example. Moving dirt, sand, gravel, ore, it works fast handling smooth loads. If it is on a long job of clearing large rock, however, it will move slower and receive heavy jars and shocks. A different Red-Strand wire rope construction will probably absorb the shocks better and last much longer.

Take *your* equipment for another example. Whatever your business and however you use wire rope—if unusual conditions arise call in your Leschen technical man. Leschen makes all types, knows the special advantages and qualities of every one, and can help you choose the rope that will do your job best—on shovels or any type of equipment. Leschen wire rope is working profitably in every industry.

Your Leschen man can easily be reached through your nearby Leschen distributor. See him soon.

Depend on Leschen's higher-than-rated quality for longer-than-expected service.

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HERCULES *Red-Strand*® WIRE ROPE
LESCHEN WIRE ROPE DIVISION
H. K. PORTER COMPANY, INC.
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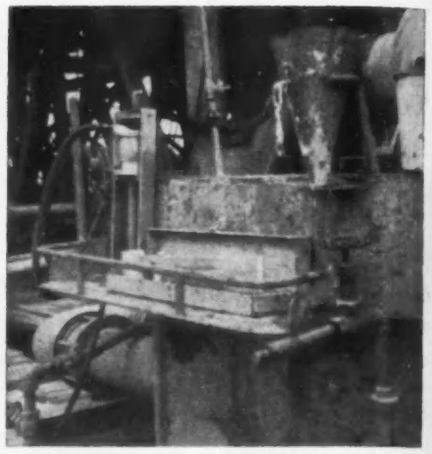
HINTS . . .



Mud Testing Platform Mounted on Shale Shaker

Few mud testing areas could be more convenient than the one constructed here by a Gulf Coast contractor. The testing area is mounted on the frame of the shale shaker.

The platform consists primarily of a rectangular piece of sheet metal welded perpendicular to the frame of the shale shaker. A small railing is attached to the platform to keep the testing equipment from sliding. Water is piped to the platform to facilitate the washing of the mud equipment, making mud, testing equipment and water available without taking a step.

Rubber Foot Warmer on Rig Increases Safety, Comfort

One progressive and safety-minded oil company provided electric foot-warmers for the derrickman and driller during sub-freezing weather, recognizing that it is difficult for a person suffering from the cold to keep his mind on his work.

The footwarmers which are constructed of rubber, not only keep the derrickman comfortable, but also provide a slip-proof working area.

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Through its 30 years of service
to the petroleum industry,
Petty has a world-recognized high score.
Our able, experienced personnel
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in search of even better ways and means
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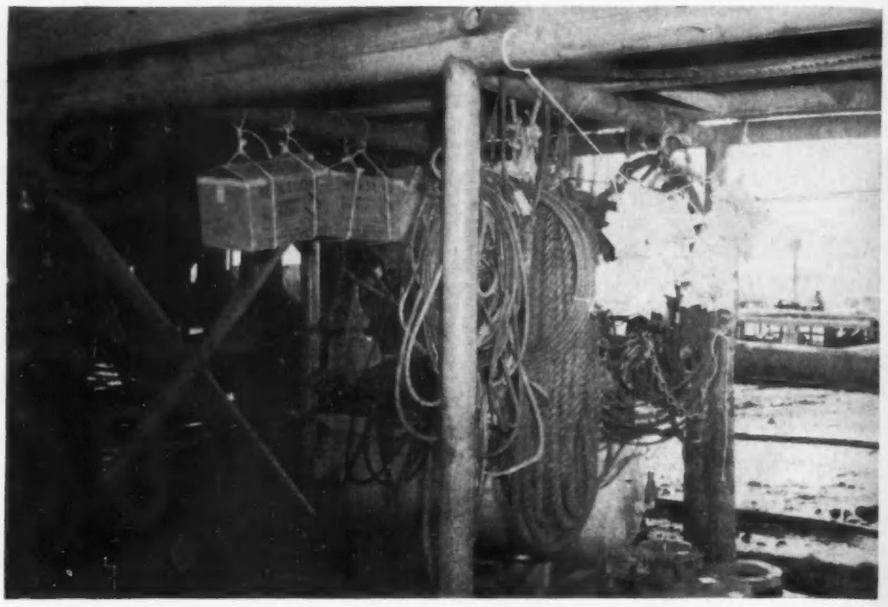

Store Supplies Under Rig Substructure

To bring about substantial savings in packaged supplies, cordage and other easily-damaged materials involves little more than a few minutes more time and a short length of clothesline rope.

Whenever spare cordage, electric light cable, etc., is to be stored temporarily, group it in the otherwise-wasted space beneath the rig substructure. The area is out of the way of operations, yet shelters materials

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HELPED TO DRILL MILLIONS OF 'EM
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They remove and prevent scale and corrosion automatically, and promote constant, care-free operations. Guaranteed absolutely harmless to personnel and equipment.

If you're not using the modern means of scale and corrosion prevention—Go Modern the Sand-Banum Way; more power from less fuel; fewer shut-downs.

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Double Duty Aluminum Paint

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AMERICAN SAND-BANUM COMPANY, Inc.
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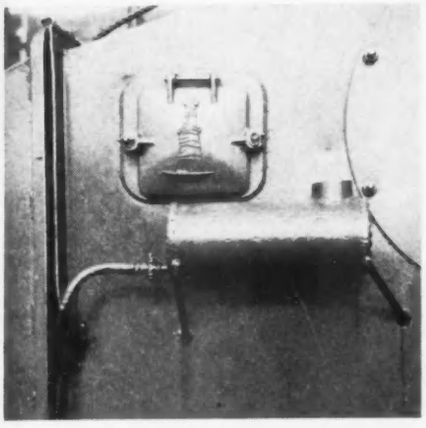
from wind, rain and strong sunlight and assures their not being laid down in water or mud at various places around the rig. Sample bags, cases of oil filter elements packaged in cardboard containers, air hose, electric cable and cordage are typical of the items that can be stored in this manner.

Keeping such goods off wet and muddy ground not only keeps them in dry, readily usable condition when needed, but reduces time involved in their handling when the rig is moved to the next location.



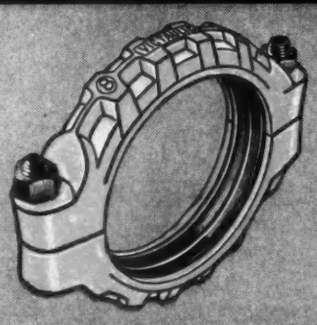
Oil Reservoir Insures Rotary Chain Lubrication

On Powell Drilling Company rigs at Wichita, Kansas, the mechanic has a vessel welded to the side of the rotary chain housing for feeding lubricating oil as the machinery is running. The engine man fills the vessel every tour and adjusts the petcock so that it will take an eight-hour interval to drip onto the chain, giving constant lubrication.

Another advantage is the slight cleaning action caused by an excess of oil being thrown off with dirt particles that might otherwise collect. Since installing this device, wear on the rotary chain has become almost negligible. Whenever the housing is taken off, the rotary chain is found to be gleaming clean from the cleansing action of the lubricant.

As shown, the vessel consists of a short length of four-inch pipe welded shut on both ends and a two-inch filler cap on the top. It is tack-welded to the side of the housing by two quarter-inch pipe legs. The quarter-inch outlet is fitted with a petcock and a neoprene hose which leads to a point above the rotary chain.

VICTAULIC METHOD OF PIPING



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Styles 77, 77-D for standard applications. Simple, fast to install—sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light duty applications. Sizes 2", 3", 4". Additional styles for cast iron, plastic and other pipes. Sizes through 60".

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Complete line of Elbows, Tees, Reducers, Laterals, etc.—to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes ¾" to 12".

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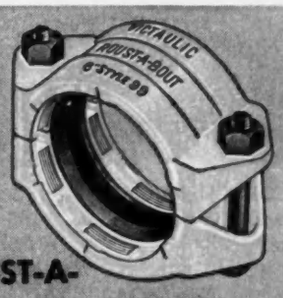
Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle—operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".



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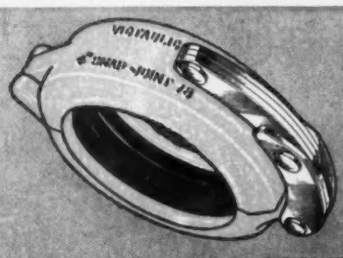
Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 8".



VICTAULIC SNAP-JOINTS

Victaulic's new boltless, speed coupling. — Style 78 — hinged into one assembly. Hand-locks for time and dollar savings. Sizes 1", 1¼", 2", 3", 4".

EASIEST WAY TO MAKE ENDS MEET

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog-Manual 55-6G.

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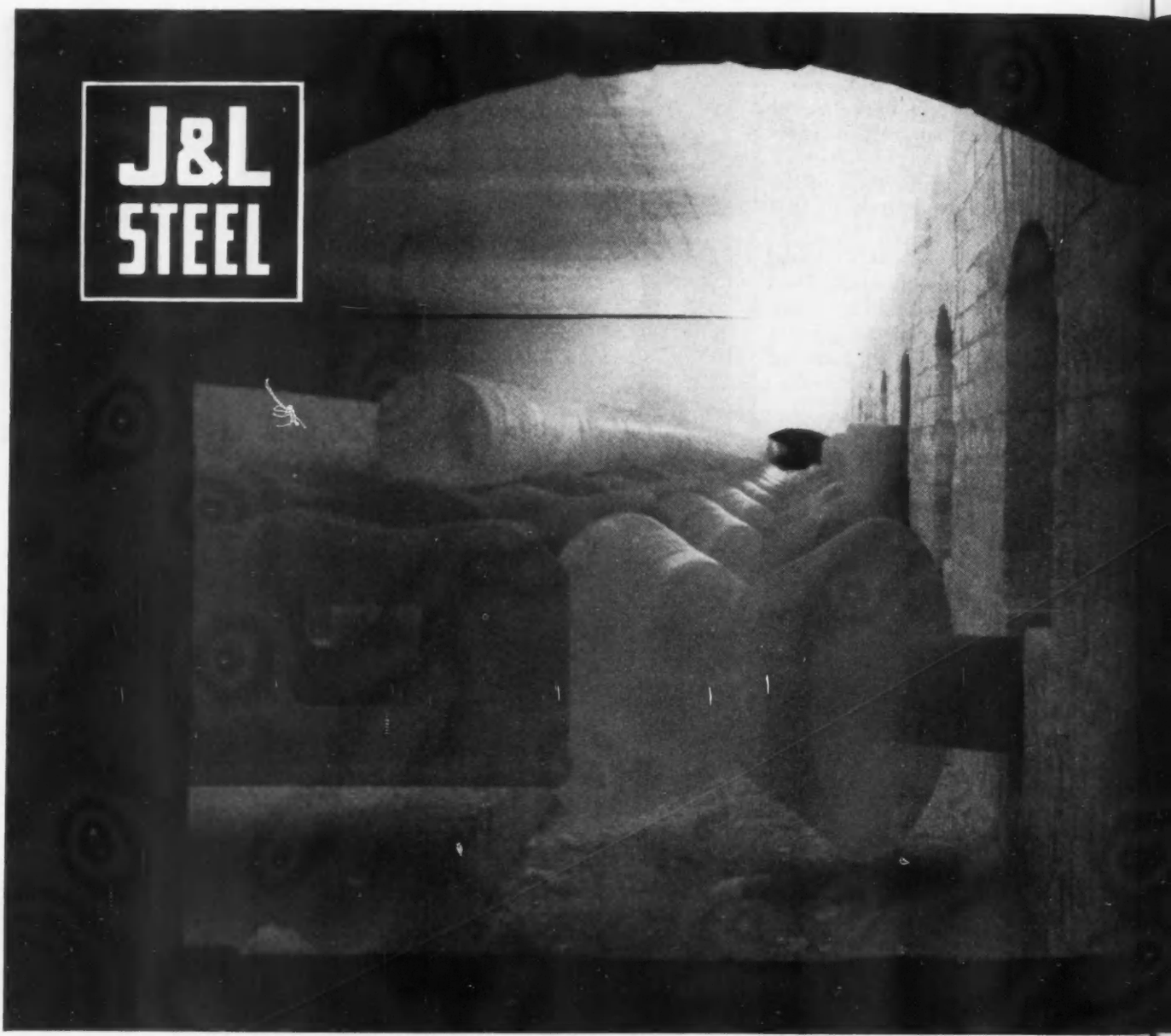
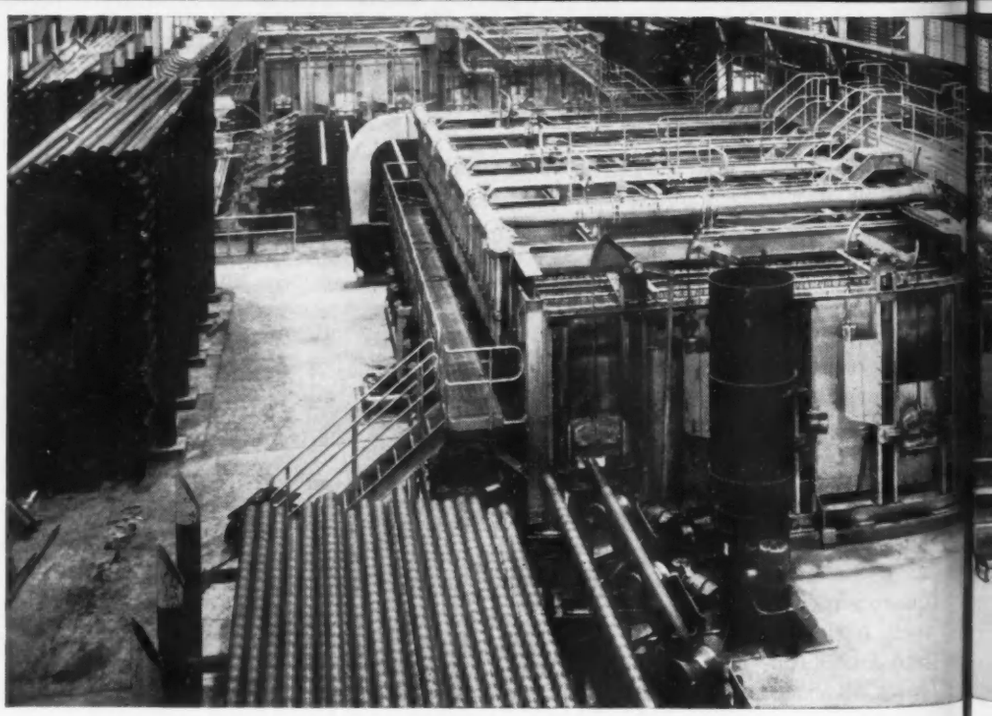


INTERIOR of high temperature 1650° F. furnace. The pipe moves through slowly from left to right on the conveyorized furnace bottom, passes out the exit door in the background.



OVER-ALL VIEW of J&L's new Seamless Tube Specialties Department at Aliquippa, Pa. High strength seamless steel pipe progresses automatically from the feed table in the foreground, through the heat treating furnaces in the center of the picture and into straightening, cutting and threading machines.

MORE HIGH STRENGTH CASING

J&L installs unique hearth type furnaces and quenching unit to meet driller demand

Drillers' growing need for an increased proportion of high strength steel casing is being met by J&L Steel through the addition of new facilities for the production of oil country tubular products.

Called the "Seamless Tube Specialties Department," the newest addition employs equipment of J&L design . . . makes possible the finishing of oil country casing by a quench and temper heat treatment that produces characteristics formerly attained through adjustments in the chemical composition of the steel. The result: by speeding up and improving its finishing facilities, J&L can furnish deep well drillers with more high strength casing up to 110,000 p.s.i.

If you're concerned with deep well drilling, J&L offers you a dependable source of high strength material.

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TO THE MIDDLE WEST AND SOUTH

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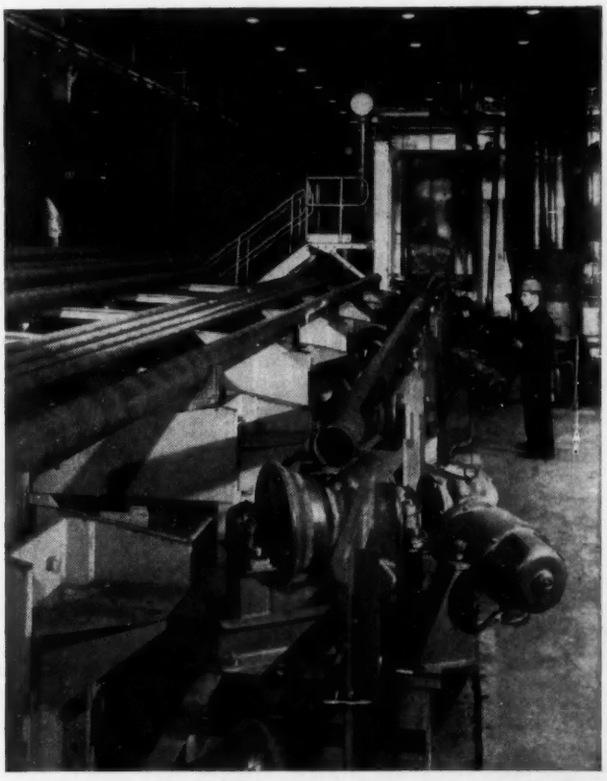
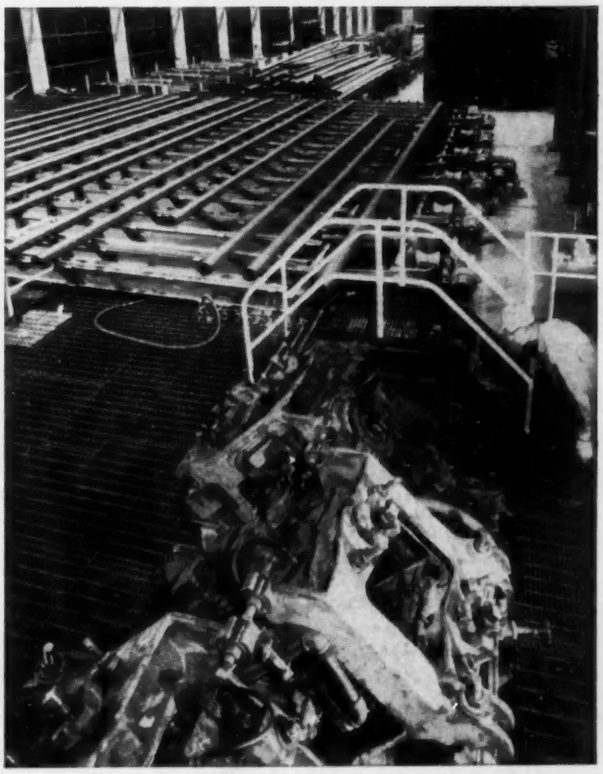


KENNETH NICHOLSON, turn foreman, checks 7-inch O.D. seamless oil well casing going into the No. 1 high temperature heat treating furnace. In this mechanically-operated, hearth-type, gas-fired furnace the pipe is normalized.



A THREE-STAND REDUCING MILL, foreground, at the exit end of the No. 2 tempering furnace, sizes the pipe to exact diameter. The No. 2 cooling bed in the upper left quarter of the picture moves and assembles the pipe for further processing.

Stops Sanding

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NEW
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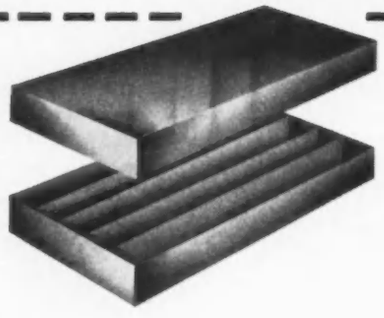
CORE BOXES



Each box holds 10 feet of core, and has following copy on end:
Hole_____ From_____
To_____ Box No._____
"Project Name" printed on top and bottom of box.

Size	Length		Width		Depth
AX CORE BOX	24	x	8¼	x	1⅜
BX CORE BOX	24	x	9½	x	1¾
EX CORE BOX	24	x	7	x	1⅛
NX CORE BOX	24	x	12	x	2¼
SPECIAL 2½" CORE BOX	24	x	13⅞	x	2⅝
SPECIAL ANY SIZE					

Samples available on request. Small shipments made immediately as we carry small stock of all sizes at all times. Write for catalog sheet.

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HINTS . . .

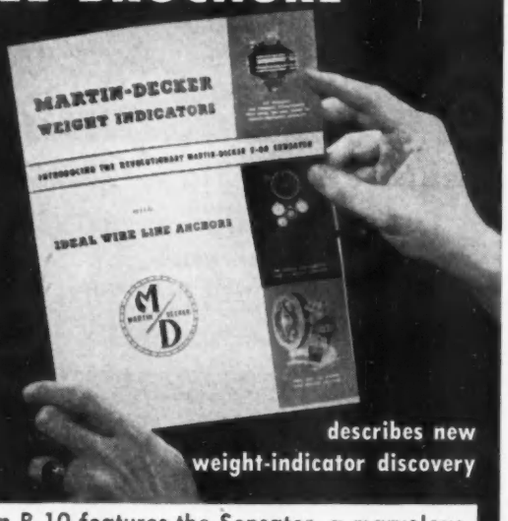
Key-Slot System Used To Join Pipe Rack Sections

The system shown for joining pipe rack sections without bolts is strong enough to be used for carrying very heavy drill pipe and casing loads. Key to the system exists essentially in the key-slot idea which permits the transverse rack members to be dropped into place quickly and easily without need for further securing or locking to hold them in place.

Solid plugs, with deep circumferential grooves cut in their outer ends, are welded into the ends of the 2-inch pipe horizontal transverse members and, at corresponding levels, key-type slots are burned into the vertical 7-inch pipe supports of the logitudinal members. When it is dropped into the slot, the transverse rack member is held in place by its own weight.

Positive alignment and rigidity of the adjoining ends of the I-beam sections forming the top rail of the longitudinal rack section is made possible by a solid steel round bar, pinned at each end when in place, which is thrust through two short lengths of pipe welded into the centers of the I-beam webs.

FREE BROCHURE



describes new weight-indicator discovery

Bulletin P-10 features the Sensater, a marvelous new kind of Ideal anchoring-type diaphragm pressure transformer for Martin-Decker Weight Indicators. The rugged Sensater strokes like a piston, but has no friction-causing piston-rod or packing. It always sends accurate, no-lag, hydraulic signals to the drilling-control instrument. Write Martin-Decker, 3431 Cherry Ave., Long Beach 7, Calif., Dept. B-2.

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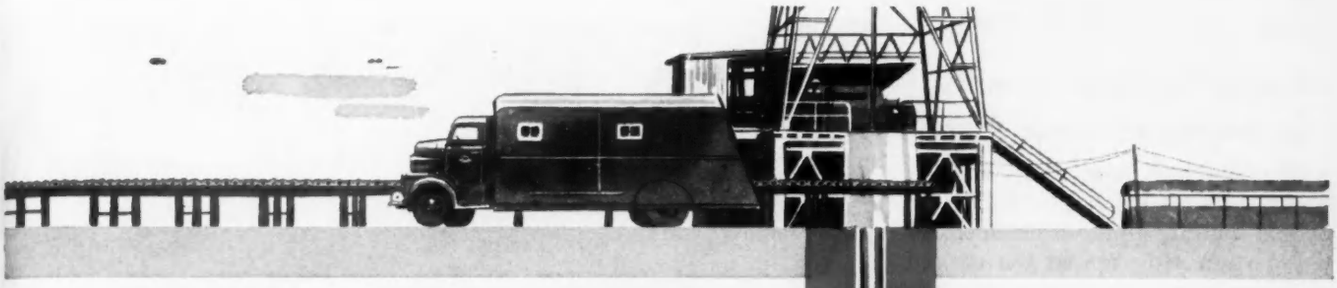
HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA



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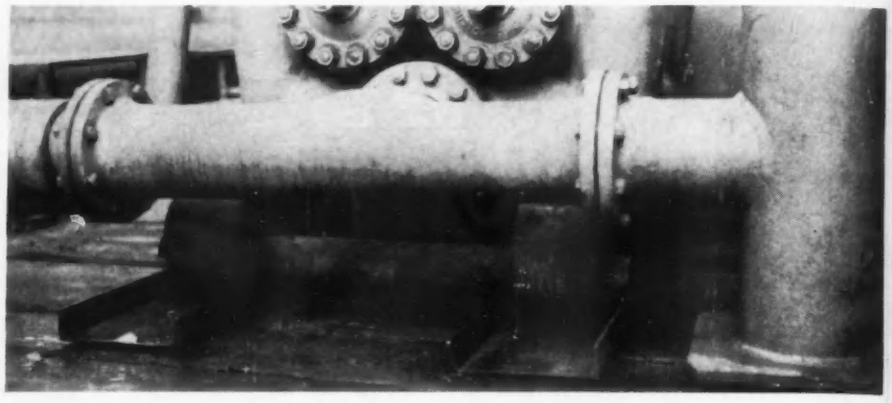
HINTS . . .

Channel Sections Simplify Positioning of Slush Pump



Moving and final positioning of heavy slush pumps can be facilitated by first spotting a pair of channel sections, open side up, in the desired place on the mat or ground. Not only do these channels help in guiding the pump when it is lowered from the truck bed, but subsequent minor shifting with crowbars is simplified when mud lines are lined up and flanged together.

A small amount of grease or crude oil smeared on the channel before the pump is lowered into place will help ease the job of barring the heavy unit into its final position.

Also, the channels will bridge shallow irregularities in the mat or ground and provide a smooth, flat surface on which pump skid members can rest.

Rig Runner KNOWS ALL

What Facts Do You Want?

Rig Runner automatically produces a record of procedure for the engineer, a drilling report for the driller, a complete record for the toolpusher. Rig Runner shows accurate drilling time for the geologist and gives management a complete breakdown of costs.

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WARREN AUTOMATIC TOOL CO.

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Stake-Mounted Lamps Give Wide Area Illumination

When welding around the drilling rig at night, particularly in the open on relatively large structures, it sometimes is desirable to have general wide-area illumination around the welding unit in addition to one or two spots or floods that can be concentrated on a particular part of the over-all job.

One Canadian welder equips his field welding truck with two general purpose lights, each mounted on a square hardwood stake inserted in the stake hole in the rear corner of the pick-up truck body.

Mounted in this position, the lights do not interfere with normal movement around the welding unit, yet are high enough and sufficiently spaced as to afford a broad range of general illumination for night operations. In the installation shown, the insulated cord supplying the lamps was run through the tube-like rolled edge of the pick-up body sides, thus avoiding necessity of stringing extra conduit.

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Scope . . . value . . . and trends of . . .

Hydraulic Fracturing in the Permian Basin

Fracturing has an enviable record to date—13,200 jobs and an estimated increase in reserves of 120 million barrels of recoverable oil.

By R. E. HURST, J. M. MOORE and J. T. ROLLINS
Dowell Incorporated, Midland, Texas

IN SIX SHORT YEARS, fracture-type treatments have grown from obsecurity to become the principal means of stimulating oil and gas production throughout the Permian Basin. A handful of wells was treated in 1949. Reports show that approximately 5290 fracturing treatments were made in 1954. Results have varied widely, but records show that 80 percent of those wells treated last year have been successful; that is, they have paid for the treatment and showed a continuing profit. Of significance in recent years has been the fact that wells which might normally be completed as dry holes were made into substantial producers. Old wells tending toward the stripper stage were treated and made into steady producers. Not to be overlooked is the fact that through the stimulus of fracture-type treatment, many fields and wells have been rejuvenated and their recoverable reserves have been increased greatly.

Scope of hydraulic fracturing. Approximately 98 percent of the fracture-type treatments performed in the Permian Basin area to date have been conducted in 8 out of 19 productive pay zones. As shown on the accompanying map, Figure 1, these eight grouped together cover the greater part of the Permian Basin. They are the Delaware, Yates, Queen, Grayburg, San Andres, Glorieta, Clearfork and Spraberry, all in the Permian System.

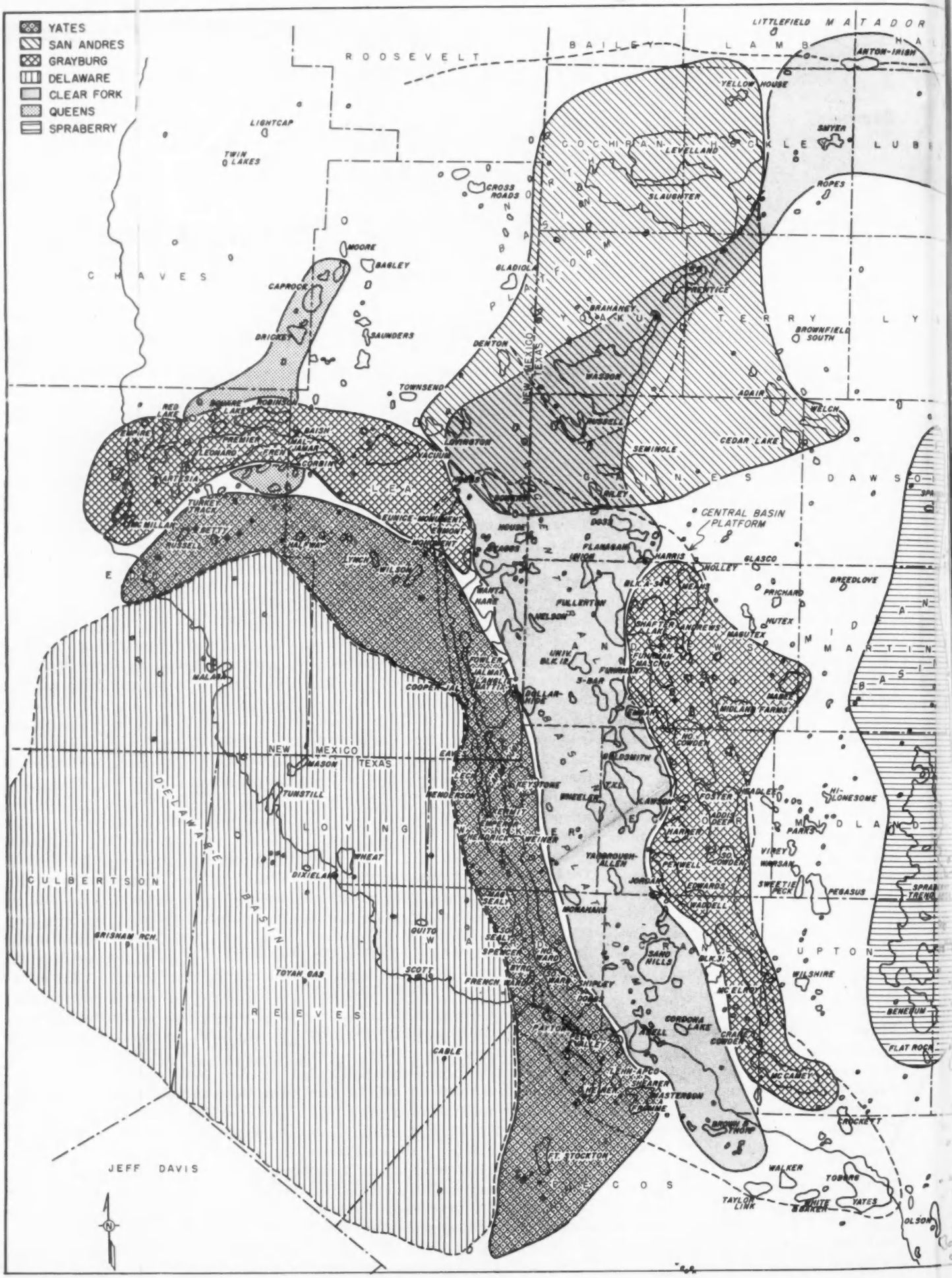
Delaware Sand is found exclusively in an area of the Permian Basin known as the Delaware Basin. This section covers approximately 10,000 square miles and lies on the extreme southwestern corner of the Permian Basin. Although this area is the largest of the eight named, it has been the least developed. Two hundred and fifty fracture type treatments have been performed on the 420 wells producing from this formation. Most of the older wells are nitro shot completions, while the newer wells have been completed by a small, fracture-type treatment, some of which are followed by larger ones.

Yates Sand, approximately the same age as the Delaware Sand, produces principally at a shallow depth on the Central Basin platform. This trend lies to the east of the Delaware Basin from Fort Stockton on the south to Hobbs on the north, curving west into Eddy County. Many of these are old wells, completed by nitro shooting and presently producing under water flood. Data is not readily available as to the total number of wells in this area, and the number of fracture type treatments performed to date. It is estimated, however, that approximately 25 percent of the Yates Sand wells, including both injection and producing wells, have had a fracture-type treatment. In some of these wells, the production is Seven Rivers and Yates, both producing from open hole.

Queen Sand active areas of production at present are in the Drickey-Caprock area. Some of the older Queen Sand production, such as the Means Pool in Andrews County, lies along the Central Basin Platform. Practically all new wells in this area are being completed by means of a fracture-type treatment, with the exception of a few completed natural. It is estimated that approximately 30 percent of the wells in this area have had one or more fracture-type treatments.

Grayburg production, as shown in Figure 1, lies mostly in a southwest trend on the east side of the Central Basin platform, then curving to the west through Lea and Eddy counties, New Mexico. In the past, acidizing treatments have not proved particularly advantageous as a stimulation method in this formation. An intensive fracture-type stimulation program is now in progress, the total number of treatments to date being exceeded only in the Spraberry trend.

San Andres production is essentially on the North Basin platform of the Permian Basin. It is interesting to note that very few fracturing treatments have been attempted in this area, whereas two pools outside of this marked area, the Moore Pool and the Harper Pool, are undergoing an extensive stimulation program. Some statistics show these pools to be part


YATES
SAN ANDRES
GRAYBURG
DELAWARE
CLEAR FORK
QUEENS
SPRABERRY
ROOSEVELT
LITTLEFIELD
MATADOR
BAILEY
LAMB
HALE
ANTON-IRISH
YELLOW HOUSE
SMYER
COCHRAN
LEVELLAND
SLAUGHTER
ROPES
LUBBOCK
LIGHTCAP
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TOWNSEND
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WELCH
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MASON
HO-CONDEN
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CROCKETT
FT. STOCKTON
JEFF DAVIS
PECOS
WALKER
TOBOSA
TAYLOR LINK
WHITE BANKER
YATES
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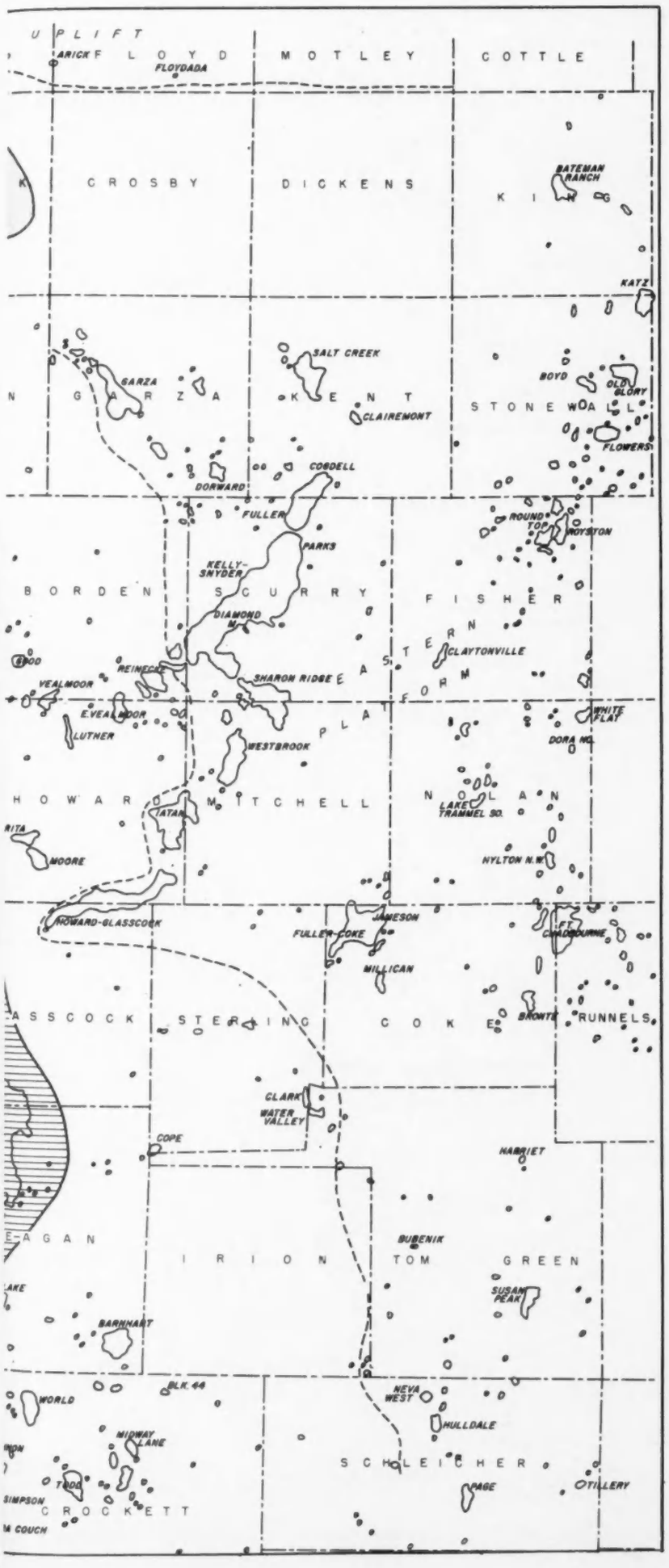

of the Grayburg, however, it is beyond the scope of this paper to establish their exact identity.

Glorieta. (San Angelo)—Formation is not identified on the map in Figure 1 as a specific trend, and todate has been of importance only from the standpoint of data from two pools; Dorward in Garza County, and Itaan East Howard and surrounding area in Mitchell County. (Early statistics carry the Dorward as San Andres).

Clearfork trend, as shown in Figure 1, covers a large area in the middle of the Central Basin platform, extending from McCamey north into the Midland Basin near Lubbock. Most of the fracture-type treatments have been confined to the Goldsmith and TXL Clearfork. Recently, encouraging results have been obtained in the Prentice and the Lee Harrison pools. A thick section of Clearfork, under the San Andres in the Wasson Pool, has not been treated to date but could be expected to react very favorably. The Clearfork should have a bright future, if fracture-type treatments are applied.

Spraberry. Out of some 3000 producing wells in the Spraberry trend, over 700 of these have had a large fracture-type treatment (20,000 gallons or more). Most of these had a small fracture treatment on completion, followed by a larger gallonage treatment later in the well's life. Recently, an operator performed a third fracture-type treatment on his well, consisting of 40,000 gallons of oil and 70,000 pounds of sand. The use of fracture-type stimulation treatments in the Permian Basin originated in the Spraberry trend, rapidly spreading to other areas.

Growth of fracture treatments. During the early days of fracture-type treatments, following their introduction in 1949, the demand for this new type of stimulation treatment was limited, there being only a slight increase in the number of jobs performed per month, during 1949 and 1950. Early in 1951, the value of fracture-type treatments was recog-

FIGURE 1—Hydraulic formation fracturing has found considerable success in a major portion of the Permian Basin as shown on this map. Extent of seven productive formations is indicated, and wells drilled or produced from these horizons in the areas shown have experienced stimulation by fracturing.

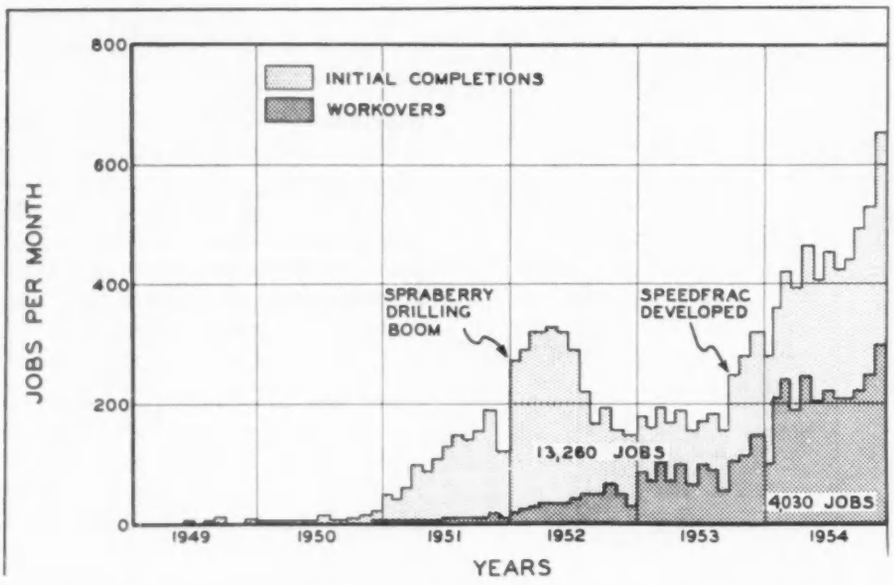

FIGURE 2—Growth of fracture-type treatments according to application are graphically shown above by years.

nized in the fast developing Spraberry field. As a result, the number of treatments per month increased rapidly (Figure 2), increasing from 25 per month in December, 1950, to 310 per month in June, 1952. In the latter half of 1952 and the first part of 1953, the total number of treatments per month dropped to an average of 180. This drop in total number of treatments was due to an almost complete shutdown of the initial completions in the Spraberry field.

This slowdown period provided excellent opportunity for research, and the development of new and improved methods of fracturing. Also, the application of fracture type treatments was diverted from initial completions to remedial workovers in other areas. On June 15, 1953 a new type treatment, now commonly called "speedfrac," was introduced to the industry. These treatments were characterized by the following improved procedures:

- Volume of treating fluid was increased from small gallonages to 20,000 gallons or more.
- Injection rate was increased from 4 barrels per minute to approximately 30 barrels per minute.
- Treatment was performed down casing, at surface pressures much lower than those when treatment was conducted down the tubing.

The "speedfrac" type treatments greatly increased the efficiency of the stimulation treatments, both on workovers and initial completions. This in turn resulted in a second rapid growth in the use of fracture type treatments for the period of October, 1953, to the present time, as may be seen in Figure 3. Total number of jobs per month increased from 150 in October, 1953, to 650 in December, 1954. Of these 650 jobs, approximately half were performed on wells under workover programs.

Another improvement in the treating technique, occurring about this same time, was the development of the use of a refined oil treating fluid. This in turn resulted in classifying the various formations, insofar as which type of treating fluid would be most applicable. Classification of fracture treatments, with regards to the type of treating fluid used, is shown in Figure 4.

Fracturing valuable two ways. The value of fracture-type treatments will be discussed from two standpoints: (1) immediate return to the producer, and (2) increased recoverable reserves, influencing future production.

The immediate returns from a fracture-type treatment are usually easy to evaluate, as they frequently result in a rapid increase in production rate from the well. Often, the additional production obtained as a result of the treatment is sufficient to pay out the cost of the treatment within a very short time. Figure 3 is a typical example which illustrates this. This lease consisted of nine wells which were fractured at a total cost of $54,000,

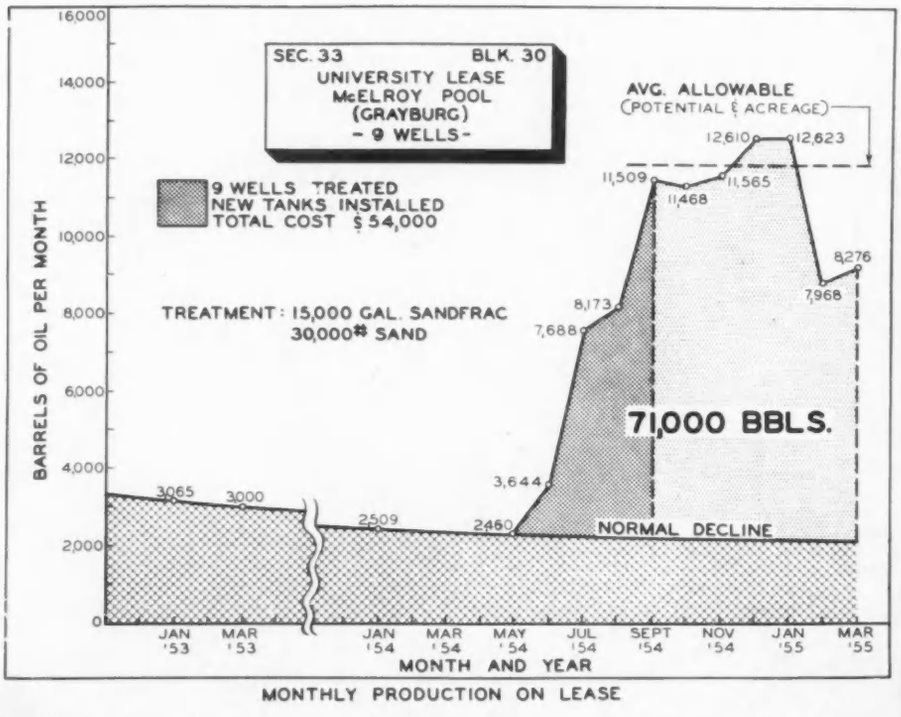

FIGURE 3—Increase in productivity of the Grayburg formation after stimulation by fracturing in the McElroy field.

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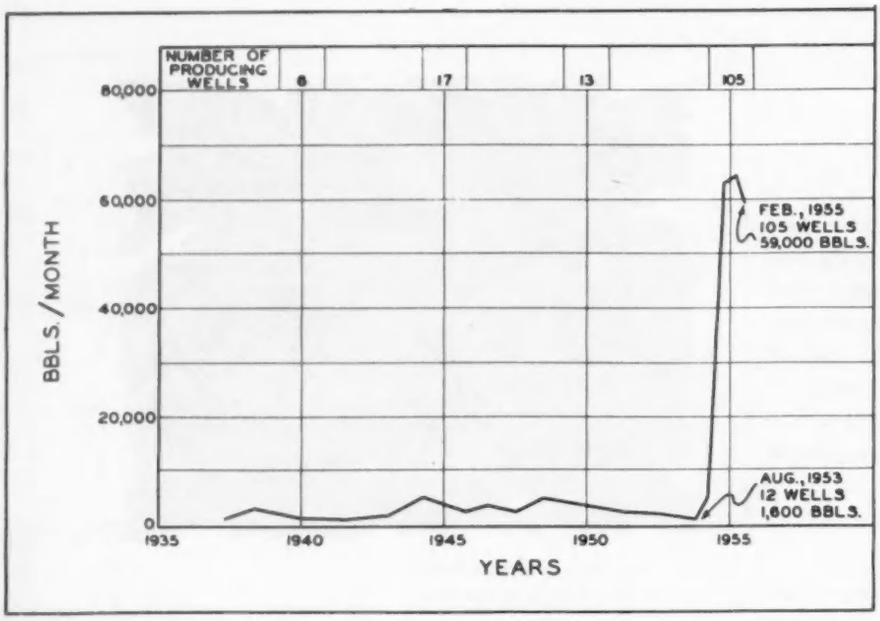


FIGURE 4—Production history of the Moore field in Howard County, Texas, shows a very marked increase in monthly output as a result of fracturing.

including rig time and all other costs. The additional production obtained as a result of these treatments was sufficient to pay out the cost of the treatments within four months. To date, a total of 71,000 barrels of additional oil has been obtained from these wells, over and above what would have been produced had the wells followed a normal decline curve.

In Figure 4 is shown the amazing growth of a field in which completions had not been too satisfactory prior to the application of fracture type stimulation treatments. During the life of the Moore Pool, producing from the Grayburg or San Andres at 3200 feet, the monthly production peak was 3000 barrels. Note that the maximum number of wells during this time was 17 in 1945, later reduced to 13 in 1950 as a result of abandonment of wells deemed no longer commercial. The main productive zone of this pool is a dense dolomite which does not respond to acidizing treatments. Accordingly, until October, 1953, all initial completions were by nitro-shooting.

In 1953 a fracture-type treatment was done on one of the new wells being drilled during a sporadic drilling program, and the excellent results of this treatment led the way to an intensified drilling boom in this field. By February, 1955, the number of wells had grown to 105 with a total monthly production of 59,000 barrels. Prior to August, 1953, the cumulative production was less than 500,000 barrels; by March 1, 1955, the cumulative production amounted to more than 1 million barrels. Practically all of the new wells had potentials of more than 70 BOPD. Commercial limits of the field seem to be reasonably defined, although a reduced drilling program is still in progress.

The Harper Pool, producing from the San Andres or Grayburg at 4300 feet, is an example of the restimulation of old wells, in an old field. Discovered in 1933, with a peak production in 1938 of 225,000 barrels per month, this field started to decline in a textbook fashion. The total number of producing wells in the field has remained fairly constant at around 184 through the years. Cumulative production by late 1954 was 12,000,000 barrels.

After the application of fracture-type treatments, however, monthly production has risen from 16,000 barrels in August, 1954 to 50,000 barrels in January, 1955, and 89,000 barrels in February, 1955. This level of production was matched only in 1941-42 at the height of drilling. Daily production in August, 1954, averaged 3 BOPD per well. Wells that have since had the fracture-type stimulation treatment have been reported with re-potentials of 75 to 250 BOPD. The pool is exempt from shut-down days, and with only one-third of the total wells treated so far, even greater production is expected in the future. The history of this pool has been repeated to some degree on many other leases in the area.

The Dorward Pool, producing from the Glorieta at 2400 feet, is an example of stimulation in a newer field. Monthly production figures are shown graphically in Figure 5. Development of this pool was virtually complete by the end of 1952. The dip in produc-

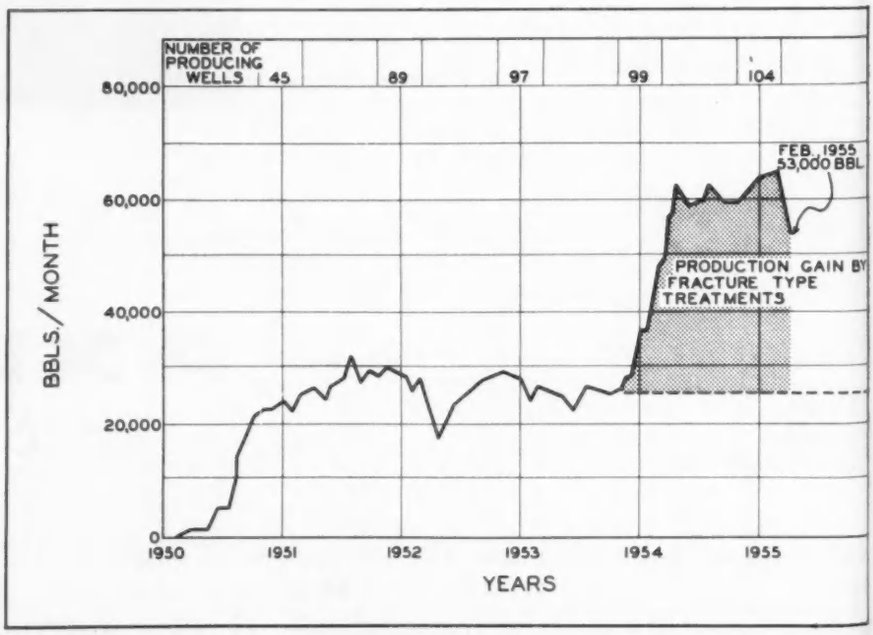
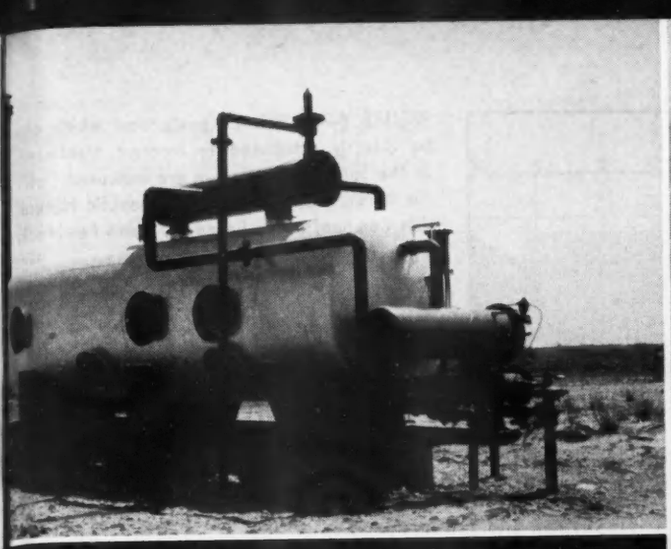
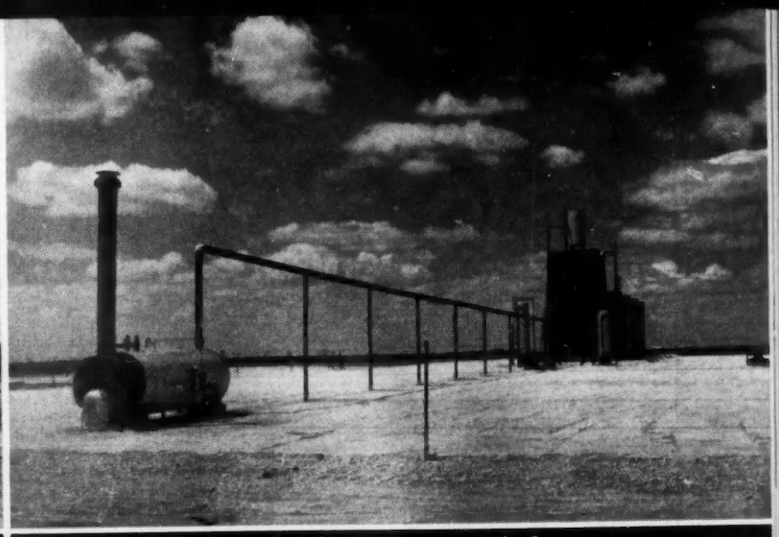


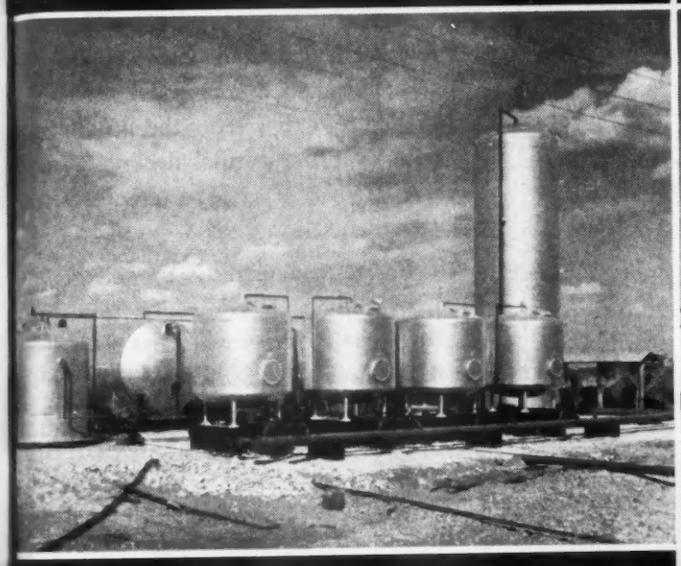
FIGURE 5—Production history of the Dorward field in Garza County, Texas, clearly shows the influence of fracturing.



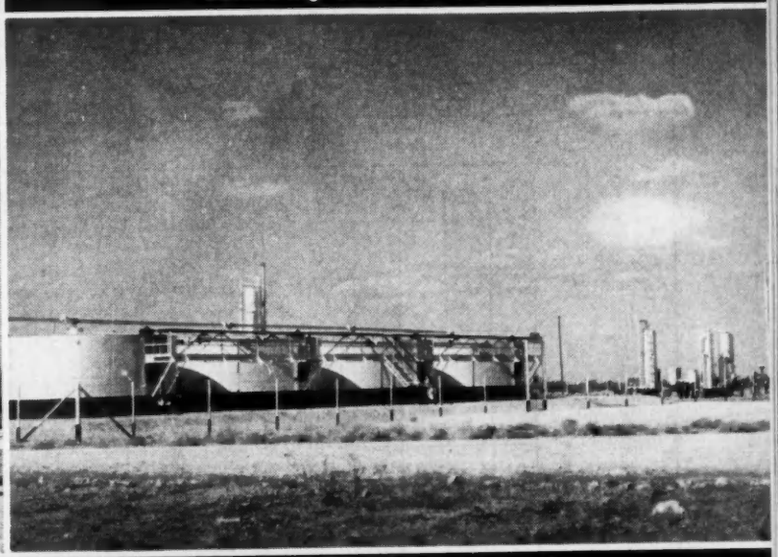
Horizontal Emulsion Treater



Wood Treater and Tank Battery With Steam Generating Indirect Heater



Water Flood Installation



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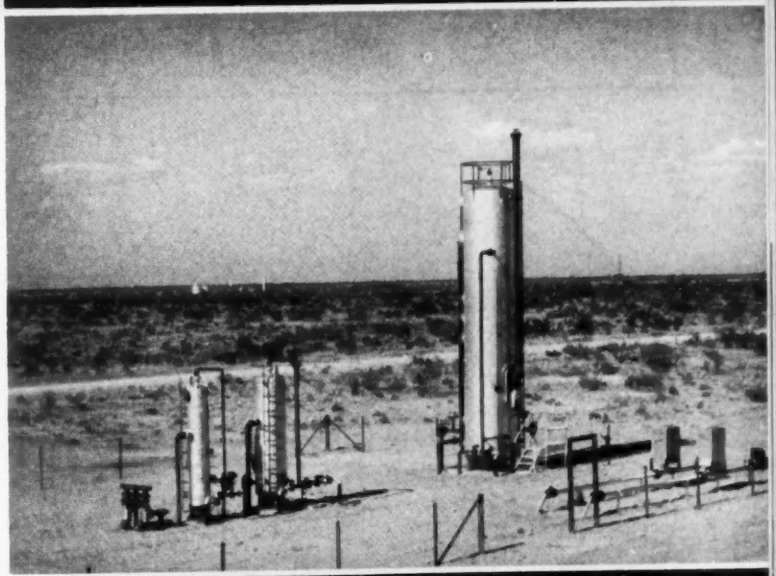

Vertical Separators and Emulsion Treater

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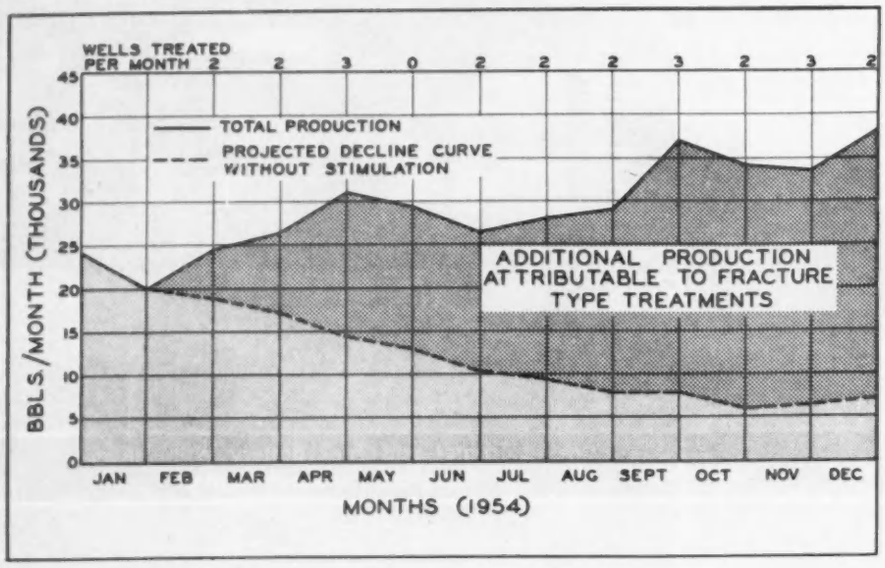
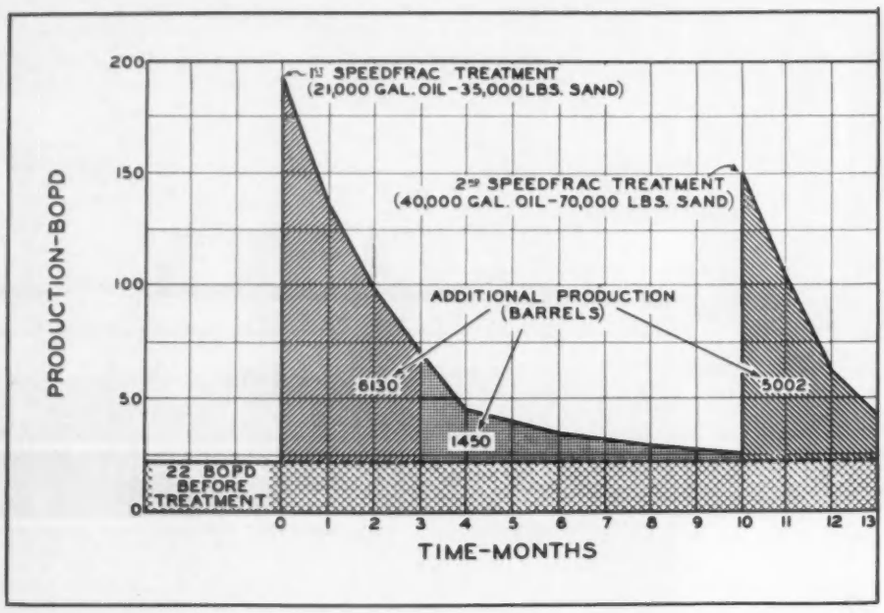

WELLS TREATED PER MONTH 2 2 3 0 2 2 2 3 2 3 2
TOTAL PRODUCTION
PROJECTED DECLINE CURVE WITHOUT STIMULATION
ADDITIONAL PRODUCTION ATTRIBUTABLE TO FRACTURE TYPE TREATMENTS
BBLS./MONTH (THOUSANDS)
0 5 10 15 20 25 30 35 40 45
JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV DEC
MONTHS (1954)

FIGURE 6—Additional production which can be directly attributed to fracture treatments of the Spraberry formation are indicated (left) for 41 wells operated by the Republic Natural Gas Company in the Benedum, North Pembrook, and Driver areas.


1ST SPEEDFRAC TREATMENT (21,000 GAL. OIL-35,000 LBS. SAND)
2ND SPEEDFRAC TREATMENT (40,000 GAL. OIL-70,000 LBS. SAND)
ADDITIONAL PRODUCTION (BARRELS)
6130
1450
5002
22 BOPD BEFORE TREATMENT
PRODUCTION-BOPD
0 50 100 150 200
0 1 2 3 4 5 6 7 8 9 10 11 12 13
TIME-MONTHS

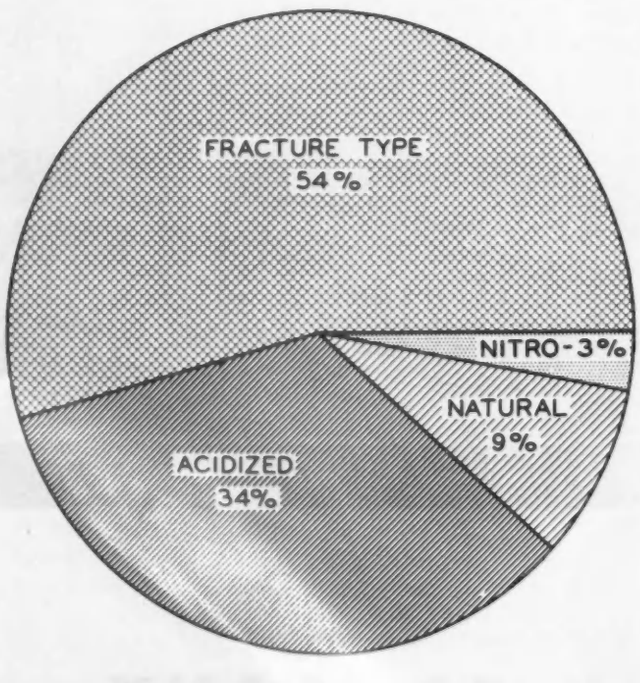


FIGURE 7—Results of repeat fracture treatments in the Spraberry formations are quite evident in this case history of the Barnett #1 well in the Benedum-Spraberry field of Upton County, Texas

FIGURE 8—Well stimulation is playing a more important part than ever before in initial well completions in the Permian Basin. Data are based upon activity for the first several months of 1955.

tion in 1952 was due to a pipe line situation. During the development period, when drilling stopped, decline started. Fracture-type treating began in late 1953, and practically all wells in the pool have been treated by this method since that date. Monthly production in June, 1953 was 24,000 barrels. By February, 1955 this production had increased to 53,000 barrels. The shaded area under the curve in Figure 5 represents the production gain over the normal decline, resulting from the use of fracture-type treatments.

Figure 6 illustrates the effects of high-volume, high-injection rate fracture-type treatments on leases totaling 41 wells in the Spraberry. The solid line shows the total gross production during 1954, while the dotted line shows the estimated production which would have been obtained if the fracture-type treatments had not been performed. The shaded area between indicates the portion of the total gross production which is attributable to these treatments. Twenty-three of the total 41 wells were treated, beginning in March, 1954. An analysis of 17 of these jobs shows a gain in net production of 112,083 barrels, and a net gain in new oil reserves of 172,167 barrels, for a total of 284,250 barrels of oil, all attributed to the high velocity, fracture type treatments. Payout time on these jobs has usually been less than three months. The estimated net profit to the operator, resulting from these jobs is in the order of 400 percent.

The graph shown in Figure 7 illustrates the benefits to be derived from additional retreatments of a well using larger quantities of fracture materials. This particular well produced from the Spraberry and was initially com-

pleted with the usual small fracture-type treatment. Production had declined to 22 BOPD by February 1, 1954. At this time a high velocity treatment consisting of 21,000 gallons of refined oil containing 31,500 pounds of sand, was performed on the well. At the end of three months, the well had produced a total of 8110 barrels of oil, or 6130 barrels of additional oil, over and above the previous production level.

By December 28, 1954, daily production had again declined to 22 BOPD. On January 1, 1955, the well was retreated with another high velocity job, consisting of 40,000 gallons of refined oil and 70,000 pounds of sand. At the end of three months after this treatment, the well had produced a total of 6982 barrels of oil, or a gain of 5002 barrels over the amount of oil the well might otherwise have produced during this three-month period. As a result of these treatments, the economic productive life of this well was prolonged.

Increased reserves. After completion of 13,260 fracture-type treatments in the Permian Basin, prior to March 1, 1955, a conservative estimate of the resulting increased reserves has been given as 120,000,000 barrels. These fracture-type treatments have made this increase possible by:

- New fields drilled because of fracturing.
- Stimulation of depleted wells in old fields, making possible new development within these fields.
- Stimulation in newer fields where other types of treatments failed.

Turn the page for the latest trends in hydraulic fracturing in the Permian Basin, including a quick look at. . .

- **Methods**
- **Materials**
- **Costs**
- **Field developments**
- **A look ahead**

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Fracturing Trends in the Permian Basin . . .

Methods

There are three main types of well stimulation being used now in the Permian Basin—(1) fracture-type treatments, (2) acidizing treatments and (3) shooting with nitroglycerin. On initial completions, so far this year, these types of stimulation treatments have been used on the following percentage of total wells. Fracture-type treatments, 54 percent; acidizing treatments, 34 percent; nitro shooting, 3 percent; with 9 percent of the wells being completed without any stimulation treatment. (See Figure 8).

Materials

During the period from 1952 to 1955, the size of the average fracture-type treatment has increased from 3000 gallons to 17,000 gallons, with the maximum single treatment to date consisting of 60,000 gallons. Over the same period, the average amount of propping agent used per job has increased from 3000 pounds to 26,000 pounds, with a maximum of 90,000 pounds of sand being used in a single-stage treatment. Present indications are that during 1955, treating volumes will continue to increase. It is believed that by the end of the year the size of the average treatment will reach approximately 30,000 gallons. Sand concentrations (pounds per gallon) have remained nearly constant at 1½ pounds per gallon; however, recent experimentation has resulted in the successful injection of sand concentrations as high as six pounds per gallon.

Costs

From 1953 to 1955, the average total cost for a large fracture-type treatment decreased from 37 cents per gallon to approximately 20 cents per gallon. This reduction in cost was made possible because of:

- Improved techniques of application.
- More compact horsepower in pumping equipment.
- Decreased time required for performance of the job.
- Decrease in the number of personnel required.

Field developments

Referring again to the map of formation trends and pools in the Permian Basin (Figure 1), the following pools are now being or have been actively stimulated by means of fracture-type treatments:

Grayburg Pools
- McElroy
- Foster
- Johnson
- South Cowden
- Furhman-Mascho
- Grayburg-Jackson

Spraberry Pool
- Spraberry Trend

Queen Pools
- Caprock
- Drickey
- West Dollarhide
- Means

Glorieta Pools
- Dorward
- Itaan E. Howard

Clearfork Pools
- TXL
- Goldsmith

San Andres Pools
- Harper
- Shafter Lake
- Means

Yates Pools
- Fort Stockton
- South Wickett
- Pecos High Gravity

Delaware Pools
- Tunstill
- Mason
- Wheat

Many pools in the area produce from formations similar to those listed, but have been given few or no fracturing-type stimulation treatments. It is in pools such as these that the greatest possibility for future development lies. Such pools, to name a few, are Seminole, Prentice, Wasson, Fullerton, Slaughter, Levelland, Dollarhide and the Irish-Anton.

With further improvements in materials and techniques, the application of fracture-type treatments should spread to the deeper horizons (Figure 2). Isolated applications in such sections indicate that the Pennsylvanian, Devonian, Simpson and Ellenburger all are excellent prospects for future expansion by the application of fracture-type treatments.

Fracturing looks ahead

The total number of fracturing-type treatments performed todate in the Permian Basin (13,260) may be surprising to some, as the extent to which this comparatively new well stimulation method has been utilized is not generally recognized. The total number of wells treated is somewhat less than this figure, since some of the wells have had several separate treatments during their producing life.

In the Permian Basin map shown in Figure 1, no attempt was made to name all of the smaller pools, although their importance was recognized and taken into consideration for the over-all picture. Many of the trends discussed consist of multipay areas, and it is recognized that all of the individual producing zones may not have been covered by the scope of this article. Numerous other examples could have been selected in the way of individual wells, leases or pools. Those cited, however, are typical of the results which are being obtained in the Permian Basin area, and were so chosen.

There is no intention to imply that fracture-type treatments are the answer to all stimulation problems, or that they will replace all other types of well stimulation. In fact, combination acid and fracture-type treatments are gaining in popularity, especially in wells producing from calcareous zones. However, of the three principal methods of well stimulation which have been accepted by the industry, the fracture-type is believed to be most effective in creating a permanent, beneficial physical change in the reservoir. And with regards to different treating techniques, the high-velocity, high-volume type of treatment seems to have resulted in larger, more sustained production increases.

The successes obtained from the use of fracture-type stimulation treatments are causing producers to re-evaluate their wells and leases, not only from the standpoint of stimulation instead of abandonment, but in the additional development of areas previously considered economically depleted.

ACKNOWLEDGMENT

The authors wish to thank all of the oil operators who furnished the data contained in this report for their generous cooperation.

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Charpy Impact	45
Izod Impact	90

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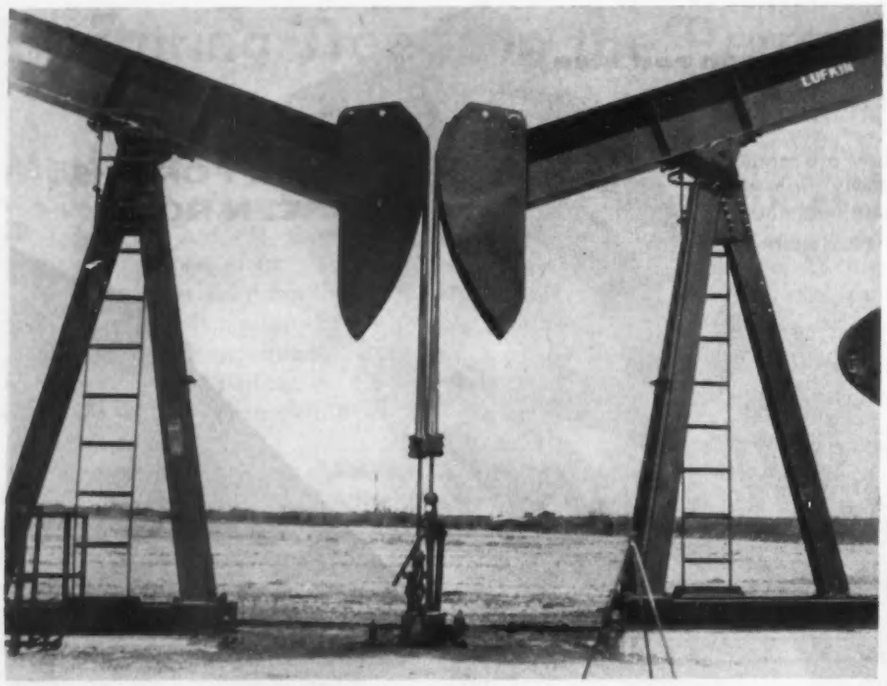

Twin pumping units on a two-zone well in West Texas.

Heights of stuffing boxes are different to prevent interference between wellheads as two strings of 2-inch tubing are only 3¾ inches apart on centers.

New Hookup Gives Flexible Pumping to Two-Zone Wells

This system was devised for independently operating two pumping units set at ground level.

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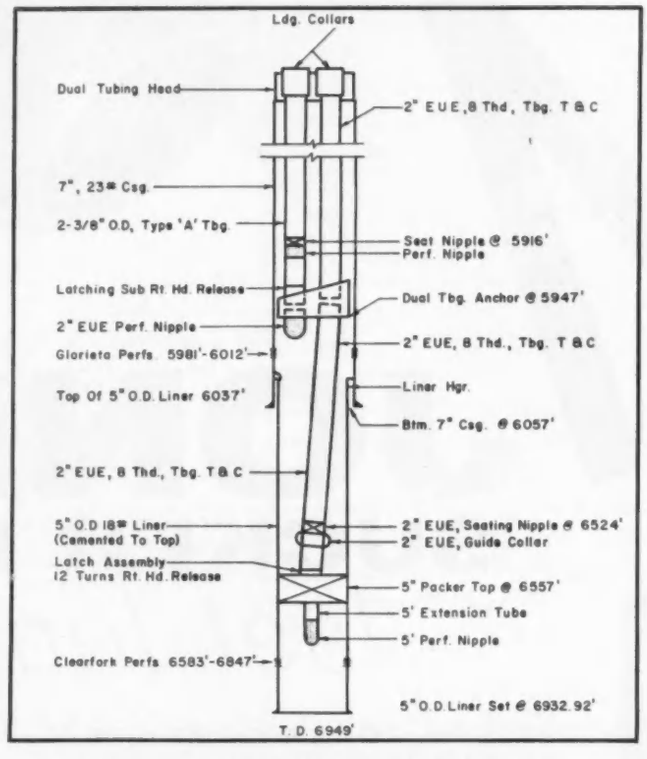
A NEWLY DESIGNED two-zone pumping installation provides economy of installation and flexibility of operation. Two individual pumping units are operated independently of the other, each at the desired stroke length and pumping speed. Expense for foundation has been minimized by setting the two pumping units at ground level.

Argo Oil Corporation, Midland, Texas, has a well which was completed in the Glorieta at 5981 feet, and the Clearfork at 6583-6847 feet. Under the supervision of Les Caldwell, Argo's engineer, a system was devised whereby the two pumping units would both be set at ground level, yet carrier bars would pass each other, even though the center distance between the strings of two-inch tubing was less than four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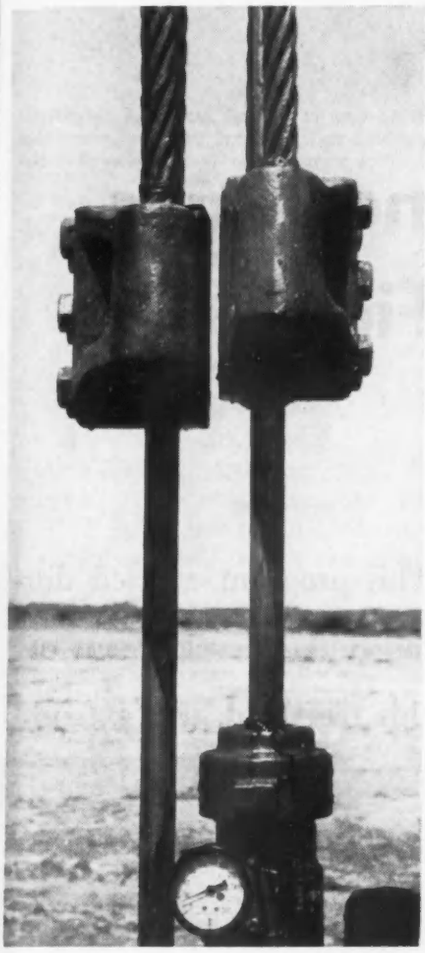
Perf. Nipple
Latching Sub Rt. Hd. Release
Dual Tbg. Anchor @ 5947'
2" EUE Perf. Nipple
Glorieta Perfs. 5981'-6012'
2" EUE, 8 Thd., Tbg. T & C
Top Of 5" O.D. Liner 6037'
Liner Hgr.
Btm. 7" Csg. @ 6057'
2" EUE, 8 Thd., Tbg. T & C
5" O.D. 18# Liner
(Cemented To Top)
2" EUE, Seating Nipple @ 6524'
2" EUE, Guide Collar
Latch Assembly
12 Turns Rt. Hd. Release
5" Packer Top @ 6557'
5' Extension Tube
5' Perf. Nipple
Clearfork Perfs. 6583'-6847'
5" O.D. Liner Set @ 6932.92'
T. D. 6949'

Diagrammatic sketch of dual completion installation.



New type carrier bars have ample clearance to pass.

inches. A special wireline hanger was designed for this purpose.

Experience to date with this type of installation has shown it to be entirely satisfactory.

Many two-zone wells are equipped with two strings of 2-inch tubing installed in a single string of 7-inch casing. While the two strings of tubing work satisfactorily in the 7-inch casing, a pumping problem is created as the polished rods are only four inches apart on centers. For each well to be pumped by its own unit, some system is needed to prevent interference between the wireline hangers of the two units. To accomplish this some operators have installed one unit at ground level and the other on a high concrete block. With this type of hook-up, the carrier bar of one unit does not travel as low as the highest point reached by the carrier bar of the other unit. The high installation cost of this method is overcome by setting the two pumping units at ground level. —**The End**

Best
Pump
for
Abrasive
Fluids
The design principle of three concentric, free-fitting tubes which use the well fluid to effect the plunger seal makes this special insert pump especially efficient in wells with excessive float sand, dirty fluid, or high bottom hole temperatures that would cause conventional pumps to stick.
The plunger is free-falling, which allows a greater strokes-per-minute rate without being hard on the rods. To compensate for the loose plunger fit, part of the production fluid is directed into the annular space between the barrel tube and the outer traveling tube and used as the sealing medium. A special no-go ring on the standing valve cage prevents the pump from becoming sanded in when idle. H-F 3-Tube pumps are fitted to A.P.I. specifications, including standard balls and seats. Either regular or on-and-off types are available in 2"x1¼" and 2½"x1¾" sizes and 12' to 25' lengths.
For hard-to-pump wells — or as a good, all-around pump for average wells — you can depend upon this pump to make good production without frequent pulling jobs. Ask your supply store, or write to us for descriptive bulletin. Harbison-Fischer Mfg. Co., P.O. Box 127, Fort Worth, Texas.
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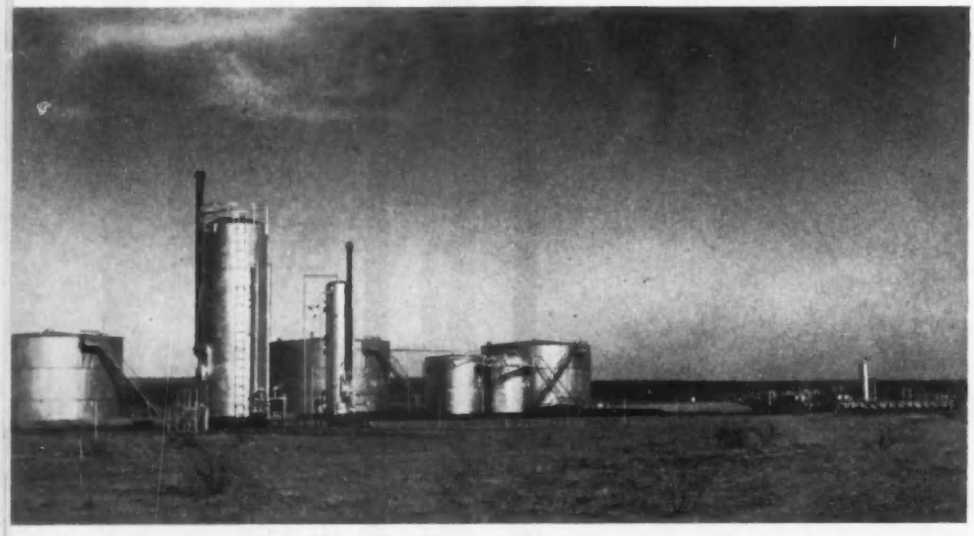
Early Pressure Maintenance Pays Dividends at Salt Creek Field



One of four centralized tank batteries showing 5000-barrel stock tanks in background, heater-treaters in foreground and flow line manifolds and separators at right.

This program, started during initial development of this reef field, will extend flowing life and increase recovery.

WHAT HAS BEEN accomplished in the Salt Creek field of Kent County in West Texas is another triumph for pressure maintenance and conservation. The producing mechanism was determined early in the life of the field following discovery in March, 1950. Development proceeded with the realization that some form of pressure maintenance would be necessary to effect maximum efficient recovery.

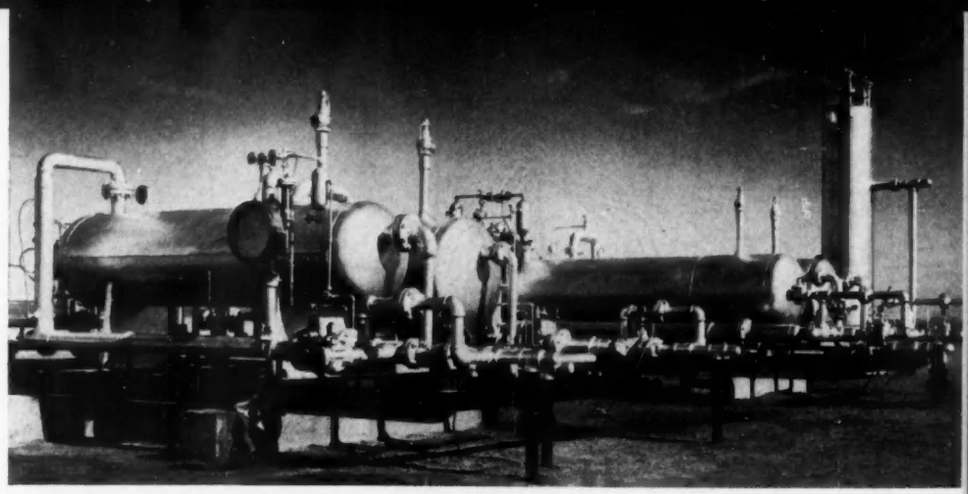
The field was 100 percent unitized (including more than 99 percent of royalty interests participating) by the time it was fully developed. The General Crude Oil Company of Houston is the unit operator. In less than two years following discovery, 109 producing wells were drilled and completed.

Plans for pressure maintenance and efforts to unitize the field were started during the early part of 1951 and resulted in approval of the Salt Creek field unit by the Texas Railroad Commission in April 1, 1952. A compression gasoline plant was completed and injection of residue gas started in June, 1952.

Water injection was started on a pilot basis in December, 1952, and was expanded to a full scale basis by May, 1953. Since August, 1953, volume of water and gas injected has exceeded reservoir withdrawals and pressure maintenance has been achieved. As a result, allowables were increased on May 1, 1954, from 14,000 barrels to 21,000 barrels per producing day, a 50 percent increase.

Description of reservoir. The Salt Creek Canyon Reef reservoir is an asymmetrical reef type structure consisting of a south or main portion containing approximately three-fourths of the oil in place, and a northwest extension area containing the remaining one-fourth of the oil in place. Figure 1 is a structure map of the reservoir with contours on top of the reef at 25-foot contour intervals. The average depth of the top of the reef is approximately 6300 feet, or 4200 feet subsea, with the highest point found to date being 3946 feet subsea. The oil-water contact has been determined to be at approximately 4425 feet subsea. There was no original gas cap. The productive portion of the reef has been calculated to contain 1,722,668-acre-feet underlying 9064 surface acres, resulting in an average thickness of 190 feet.

Analyses of cores obtained from nine wells within the productive limits of the field yield an average porosity of 9 percent and an average permeability to air of 13.2 millidarcys. The average permeability to oil, calculated from pressure build-up tests of nine wells, is 10.5 millidarcys. The average connate water is estimated to be 30 percent of pore space. Microlog cross-sections of the field show no conclusive correlation of impermeable barriers. There is no evidence of a dense lime or shale barrier separating the field into horizontal layers or segments.



Horizontal separators located at one of the four centralized tank batteries. Test unit is at left and includes both high-pressure and low-pressure separators.

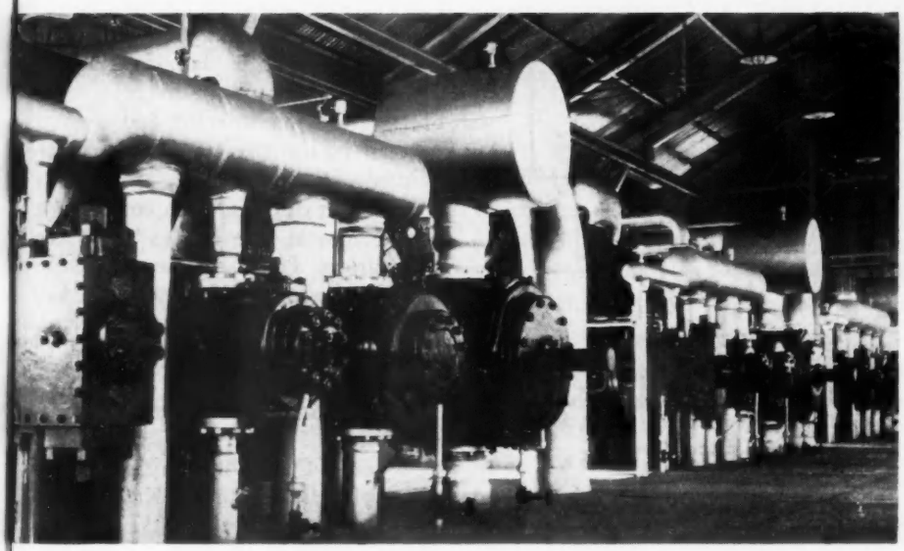
At a datum of 4400 feet subsea the original reservoir temperature was 129° F. and the original reservoir pressure was 2940 pounds per square inch gage. Gravity of the produced oil is 39 degrees API. Specific gravity of the produced gas is approximately 0.8 when separated at 185 psig and 1.25 when separated at 0 psig.

At reservoir temperature the bubble point of the reservoir oil is 1294 pounds per square inch. The formation volume factor is approximately 1.3 within the range of pressures between bubble point and original pressure. Total solution gas has been measured from reservoir samples to be 516 cubic feet per barrel. Viscosity of the reservoir oil was measured to be 0.79 centipoises at pressures above the bubble point increasing to 0.90 at 800 psi and 2.44 at 0 psi. The salinity of the produced formation water is 128,000 parts per million chloride.

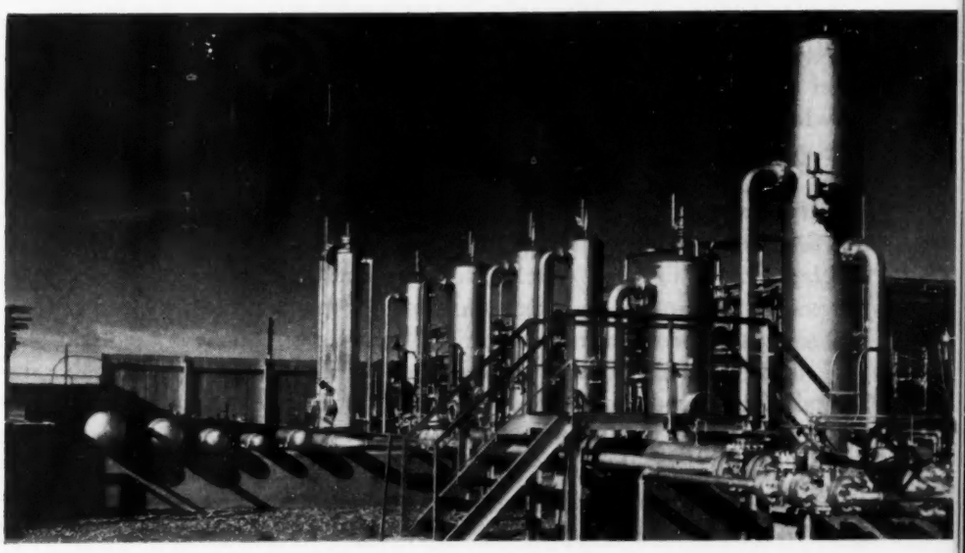
Productivity index tests of 21 wells disclosed that the productivity index of the average well is in excess of 2 barrels per day per psi drawdown. By exposing additional productive reef, the average productivity index could exceed 5 BPD per psi drawdown.

Initial pressures measured on new wells completed in areas where substantial pressure drop had occurred were found to be approximately equal in value to those of offset producing wells. Interference tests also indicated good pressure communication within the productive portion of the reef.

Drill stem tests taken in the water-bearing zone approximately 100 to 200 feet below the oil-water contact yielded pressures substantially higher



Three four-stage gas compressors (above) do the work in taking both low-pressure (15 psi) and high-pressure (185 psi) gas and compressing it to about 2000 psi injection pressure.



Compressor manifolds (right) rest horizontally on concrete foundations just outside compressor building at gasoline plant. Interstage scrubbers standing upright remove liquids between stages of compression.

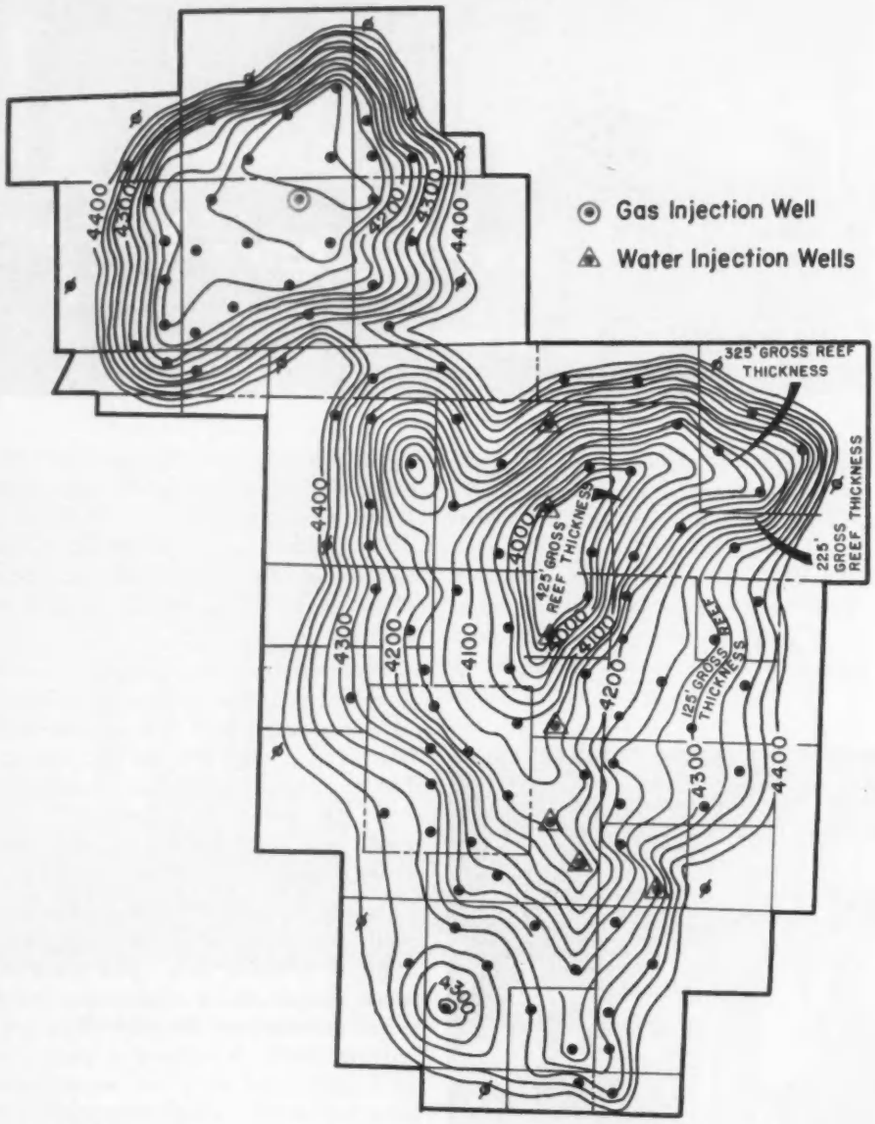


FIGURE 1—Structural map of top of the reef in Salt Creek field, Kent County, Texas. Map shows location of one gas injection well and seven water injection wells.

than those of offset producing wells. This indicates poor vertical pressure communication in the underlying acquifer a short distance below the oil-water contact. This was substantiated by the apparent absence of any effect of expansion of a sizable aquifer while the field was being produced by depletion.

Development. Upon completion of the discovery well in March, 1950, development of the Salt Creek field proceeded at the rate of about four well completions per month until June, 1952, at which time there was a total of 104 producing wells in the field. Three additional wells were completed during the balance of 1952, one in 1953, and one in 1954. The field has been drilled to a density of approximately one well per 80 acres.

Early in the life of the field, engineering studies indicated that the reservoir, containing highly undersaturated crude oil, was producing under straight depletion drive with no evidence of a gas cap or an aquifer of sufficient size to furnish additional energy. It was realized that the reservoir pressure and well capacities would decline rapidly, requiring early installation of artificial lifting equipment. Ultimate recovery and producing rates under these conditions was expected to be very low. For this reason plans for maintenance of pressure and efforts to unitize the field were started shortly after the field was discovered.

Development of the field on a wider than usual spacing program was a major part of the plan to achieve greater ultimate recovery. This development program was designed to determine the extent of the field and its characteristics at an early stage of its life so that plans for pressure maintenance could be made and carried out before the reservoir pressure had declined to the extent that major benefits of pressure maintenance no longer existed. Also, the wells not drilled because of the wider spacing plan can be drilled whenever needed and can be located at the most favorable position for greatest ultimate recovery.

Unitization and pressure maintenance. By the end of 1951 agreements for unitization of the Salt Creek field had been prepared and presented to the operators and royalty owners for execution. The unitization agreements were ratified by most of the operating and royalty interests in the field and made effective April 1, 1952, the date of Railroad Commission approval. At present, all of the working interest and over 99 percent of the royalty interest in the field are in the unit.

Fourteen different companies or operators participate in the Salt Creek unitization. They are: General Crude Oil Company (unit operator); Carroll Hunt Trust Estate; Continental Oil Company; The Superior Oil Company; Nelson B. Hunt Trust Estate; Texas Gulf Producing Company; H. L. Hunt, Jr., Trust Estate; Seaboard Oil Company; Republic Natural Gas Company; Kewanee Oil Company; Charles B. Wrightsman; Humble Oil & Refining Company; Estill S. Heyser, Jr., and Stanolind Oil & Gas Company.

Although there was insufficient gas available to maintain pressure, the initial step toward pressure maintenance was made with preparations to return all available produced gas to the reservoir. Construction of a compressor station and stabilization facilities for liquid hydrocarbons were completed in June, 1952. Gas was injected in a well located on the crest of the structure in the main portion of the field. This gas injection replaced approximately 25 percent of the reservoir space voided.

Since there was insufficient gas available to maintain reservoir pressure, efforts were directed to develop-

ing a water injection program. The primary problems involved were:

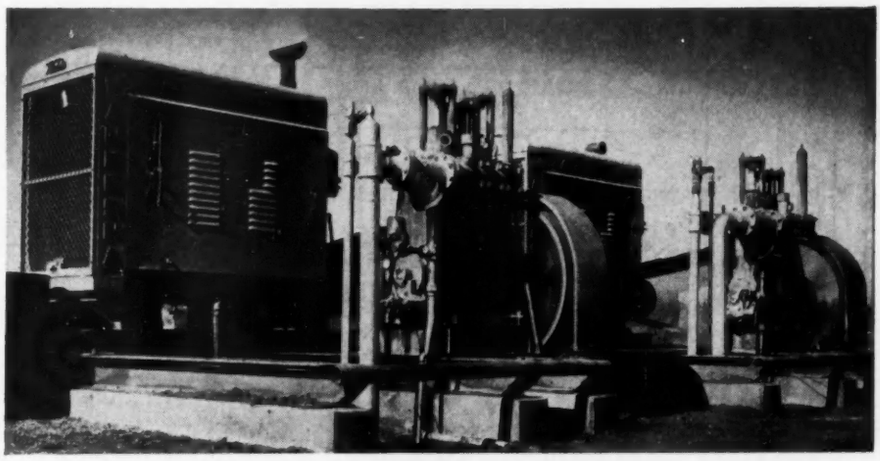
1. Locating an adequate source of water in this semi-arid area.
2. Whether or not it would be feasible to inject sufficient volumes of water into the reef.
3. Whether or not pressure gradients across the reservoir could be kept within desired limits.

The first problem was securing an adequate source of water. Consideration was given to obtaining water from the Permian sands and/or from the Ellenburger formation. It was found that the Permian sands would not yield sufficient water and water from the Ellenburger would be very costly. The problem was resolved by locating a source of water in a sand at a depth of 30 to 40 feet in the area of the juncture of Salt Creek and the Salt Fork of the Brazos River about three miles east of the center of the field. This shallow sand replenished by underflow from both Salt Creek and the Salt Fork of the Brazos River. The water is highly mineralized, having a salt content of approximately 40,000 ppm.

The production of about 9 million barrels of water from this shallow formation within the past two years has not permanently lowered the water table even though the past two years have been drouth years. Capacities of the three wells supplying the injection water have been calculated to be about 27,000 BPD from productivity index tests.

Water injection was started on a pilot basis in December, 1952, by injection below the oil-water contact into a well located outside the productive limits of the field. Approximately 100 feet of reef was open to injection. After stabilization, the injection rate leveled off at approximately 400 BPD at 2300 psi surface pressure.

Concurrent with the pilot water injection program potentionmetric model studies were conducted to determine the optimum pattern for water injection wells. Known permeability values eliminated the possibility of an end-to-end flood because excessive pressure differentials would be required to move the oil across the reservoir. A model study was made using an east-west line of wells across the "waist" which divides the south one-third from the north two-thirds of the south main body. This model study showed that the pressure differentials would be too great for efficient operation.



Largest of the three water-injection pump stations, already in operation while the building and remaining piping are under construction. (Structure has been completed since this photograph was taken.)

The model studies also indicated that the most efficient pattern not requiring excessive pressure differentials consisted of a line of injection wells running north and south down the center of the field and turning eastward at the above mentioned "waist." The model study showed that by turning the line of injection wells eastward rather than continuing southward into the thin, relatively narrow reef area satisfactory pressure differentials could be maintained.

This plan had the added advantage of providing several lines of producing wells in the south tip whereas to have continued the line of injection wells to the south into the narrow tip would have afforded only one line of producing wells. This latter solution would have decreased the opportunities for observation and control of the flood to obtain a more efficient sweep.

Since the aquifer underlying the productive portion of the reef, with the low permeability existent therein, was too thin to transmit the required energy without excessive pressure differentials, it became apparent that a bottom flood to be conducted by injection below the oil-water contact was not feasible. Consequently, in the injection wells, the full section from the top of the reef to the oil-water contact was opened to injection. This pattern and method of completion will result in a line flood moving from the center of the reservoir outward.

These potentiometric model studies were made using the assumption that the south main body of the reservoir had a uniform permeability equal to the average for the reservoir. It was realized that this was probably not the case and that subsequent model studies would be needed after sufficient production and injection history could be obtained to permit calibration of the model.

Consequently, the water injection system was expanded to provide facilities for injection of water to include the following unit wells from north to south: E-193-4, E-193-7, H-166-1, C-1, C-2, C-3, C-22, H-144-3. Injection was discontinued into the pilot well, F-13-5, in February, 1954, and into Well H-144-3 in March, 1954. Both of these wells showed low injection volumes and high working pressures and neither appeared to be contributing materially to the maintenance of pressure in the reservoir.

After acid treatment of permanent injection wells, injection pressures ranged from 360 to 1200 psi while injection rates vary from 500 to 5000 BPD.

Pressure is now being maintained in the northwest portion of the field by the injection of all the residue gas

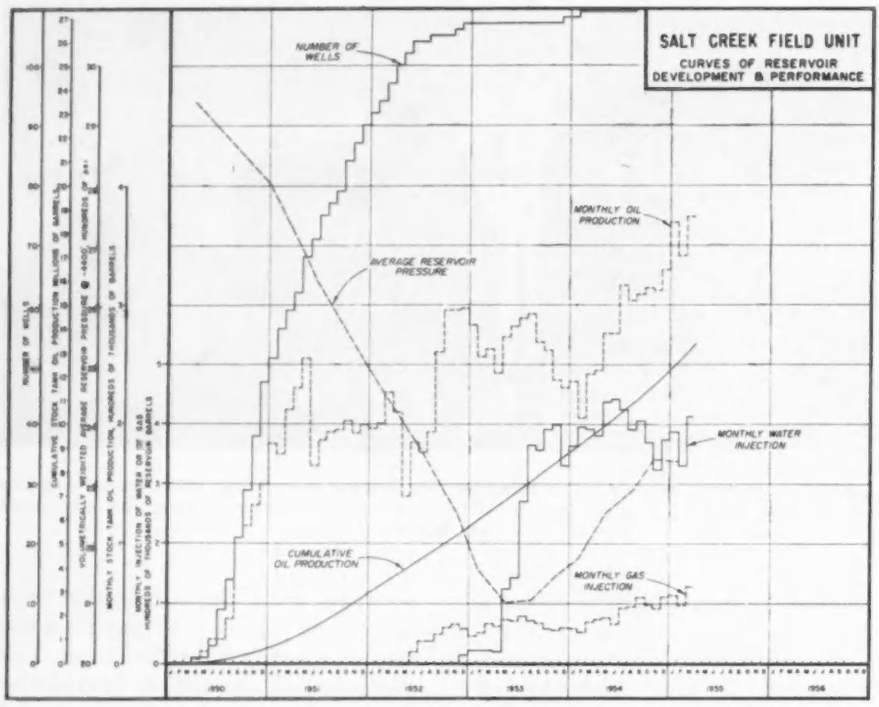


FIGURE 2—Reservoir development and performance for Salt Creek field. In a matter of months after water injection was started, the average reservoir pressure began to build up.

from the field and in the south or main portion of the field by the injection of water. In both areas, over-injection is anticipated for a limited time in order to allow a build-up of reservoir pressure. This pressure build-up is necessary so that essentially all the wells will flow with sufficient capacity to insure production of full allowable while maintaining the necessary flexibility of operation. Transfer of allowable is permitted by field rules and will be used to improve flood efficiency, pressure regulation, reduce excessive water or gas production, observe reservoir behavior and to otherwise achieve efficient operations.

Reservoir performance. Figure 2 summarizes reservoir development and performance before and after the pressure maintenance program was started. Cumulative oil production through March, 1955, totaled 13,290,000 barrels of stock tank oil. For March, 1955, production for the entire field amounted to 374,000 stock tank barrels.

The weighted average reservoir pressure, after reaching a low of 2102 psig in May, 1953, increased to 2340 psig by October, 1954. It has been stabilized somewhat at this point by the injection of an average of about 400,000 barrels of water per month while producing an average of about 380,000 barrels of oil monthly.

During the period prior to commencing gas injection in June, 1952, and water injection in December, 1952, the reservoir pressure declined 578 psig while a total of 4,299,000 barrels of stock tank oil was produced. This rapid pressure decline is characteristic of under-saturated reservoirs producing by the expansion of reservoir fluids.

Figure 3 shows volumetrically weighted average pressures plotted against cumulative stock tank oil production as percent of original oil in place for the northwest area, for the south main body, and for the total field. These curves are essentially coincident for the depletion phase for each area, showing that both areas were producing with a similar type of drive mechanism. Coincidence of the curves also indicates that insufficient oil had migrated from the northwest area to the south main body by the time pressure maintenance was strated to make a big difference in the slope of the curves.

Through March, 1955, only 2.75 percent of the total oil originally in place has been produced from the entire field. Up to this time, 2.95 percent of the total oil originally in place in the south main body has been produced, while 2.25 percent of the oil originally in place in the northwest extension has been produced. Reason for this difference was due to faster development in the south main portion of the field.

For the past two years the comparative rates of withdrawal from these two areas have been approxi-

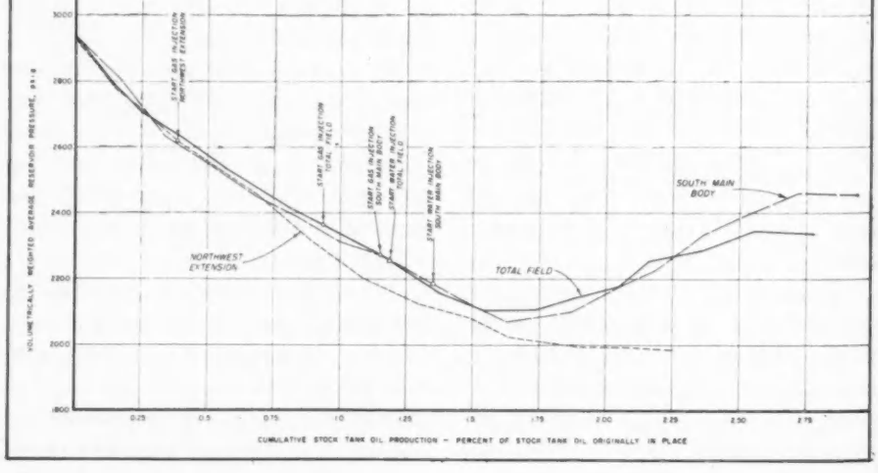


FIGURE 3—Influence of water injection on average reservoir pressure is clearly indicated on this set of curves where pressures are plotted against percent of stock tank oil originally in place which has been produced.

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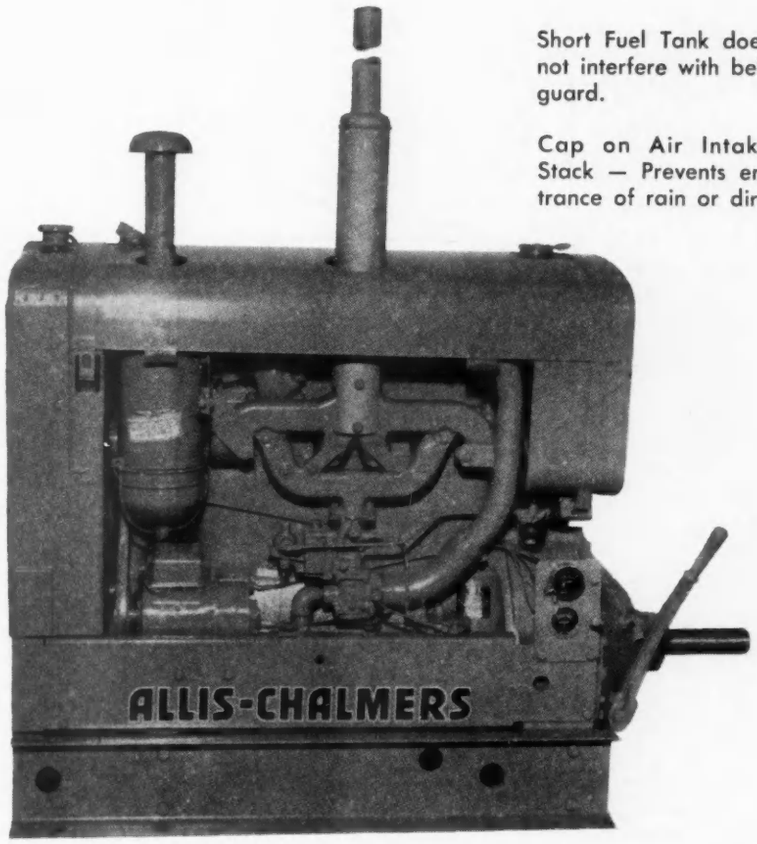

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Muffler — Quiet — No back pressure.

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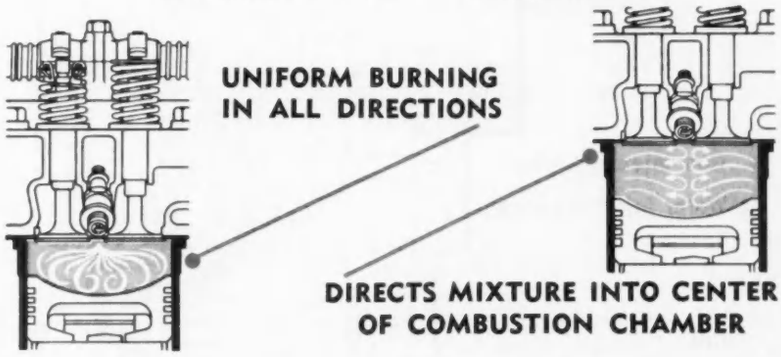

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mately proportionate to their respective volumes of oil originally in place.

Reservoir pressure. Figure 4 is a typical isobaric map for the field just prior to partial pressure maintenance. Figure 5 is an isobaric map of the field as of August 9, 1954, and indicates, by comparison with Figure 4, the shift in pressures within the reservoir as a result of controlled injection of water and gas and the controlled production of reservoir fluids. This general trend in bottom-hole pressure contours is quite similar to the pattern predicted by the potentiometric model studies.

It is interesting to note that originally the pressure gradient throughout the field was from north to south. In Figure 5 there is a noted change in direction of pressure gradients outwardly from the injection wells toward the edges of the reservoir.

Ideal case for conservation. The case of the Salt Creek field is truly an ideal one in the interest of conservation. Vision of the operators, plus the cooperation of the Texas Railroad Commission, have made this operation a successful one. Every practical engineering tool has been applied to study the reservoir's behavior and to predict its future behavior under different circumstances, to the end that the most effective practices could be planned for the efficient recovery of gas and oil.

Unitization made it possible and practical to operate this field as it should be operated for the maximum efficient and economical recovery of oil. Unitization also permits the flexibility of control to alter future plans in order to take advantage of the best methods of recovering the oil.

—**The End**

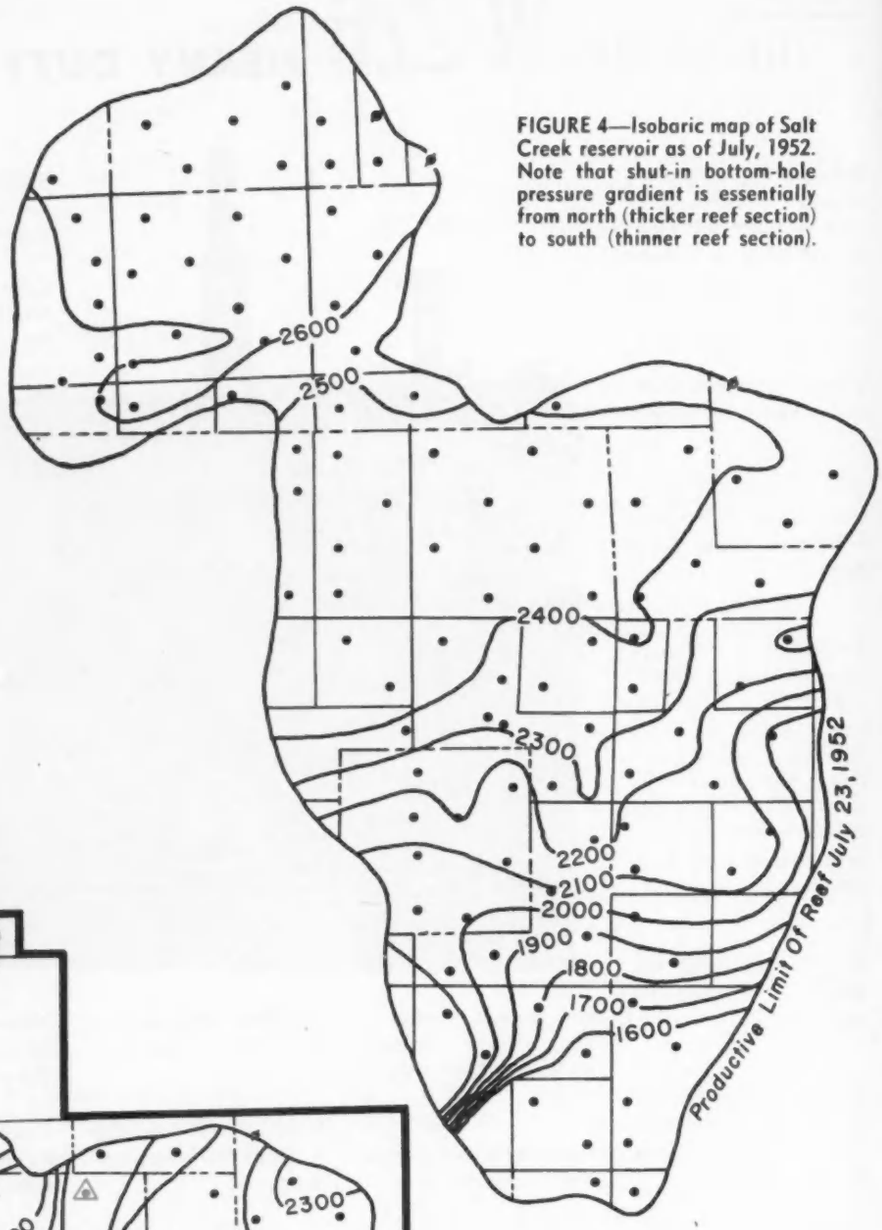


FIGURE 4—Isobaric map of Salt Creek reservoir as of July, 1952. Note that shut-in bottom-hole pressure gradient is essentially from north (thicker reef section) to south (thinner reef section).

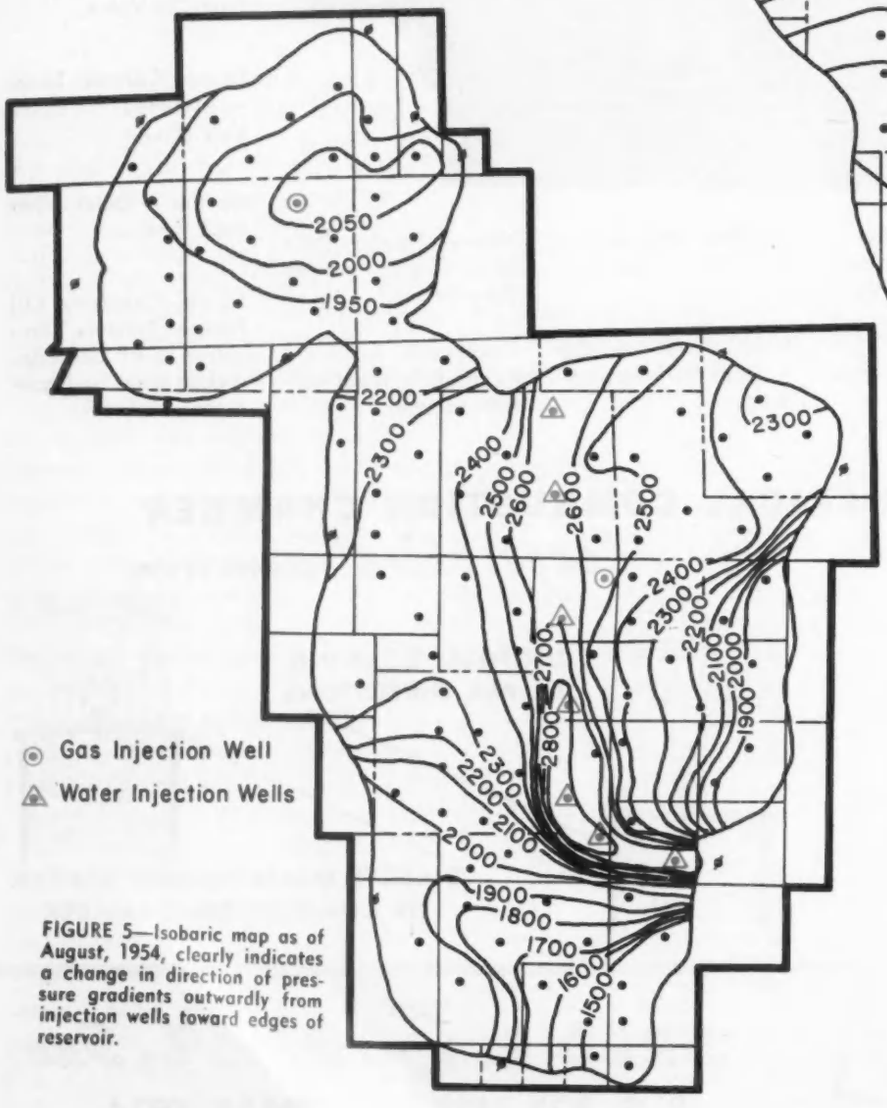
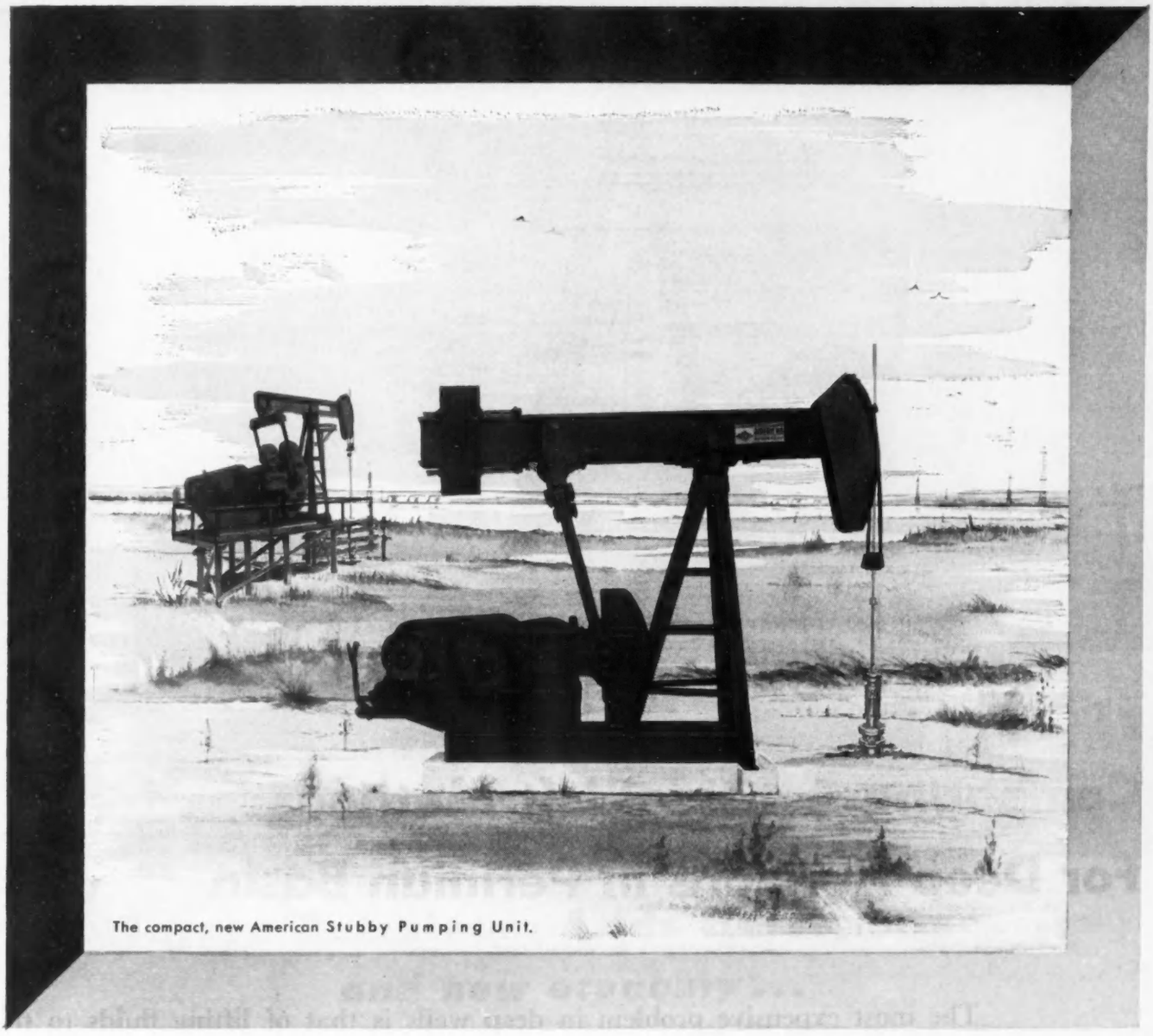


FIGURE 5—Isobaric map as of August, 1954, clearly indicates a change in direction of pressure gradients outwardly from injection wells toward edges of reservoir.



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New American Stubby Pumping Units lower installation costs

The short base on the compact new American Stubby Pumping Unit can be adapted to pumping jack foundations where old equipment is being replaced with electrically operated equipment.

On new wells where foundations must be constructed, much less area is needed. This is particularly important when the unit must be elevated because of water conditions.

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FIGURE 1—Conventional pumping unit with weight-type counterbalance and 74-inch maximum stroke.

Comparing Artificial Lift Methods For Deep Horizons in Permian Basin

The most expensive problem in deep wells is that of lifting fluids to the surface. Here's how it is done in West Texas and New Mexico.

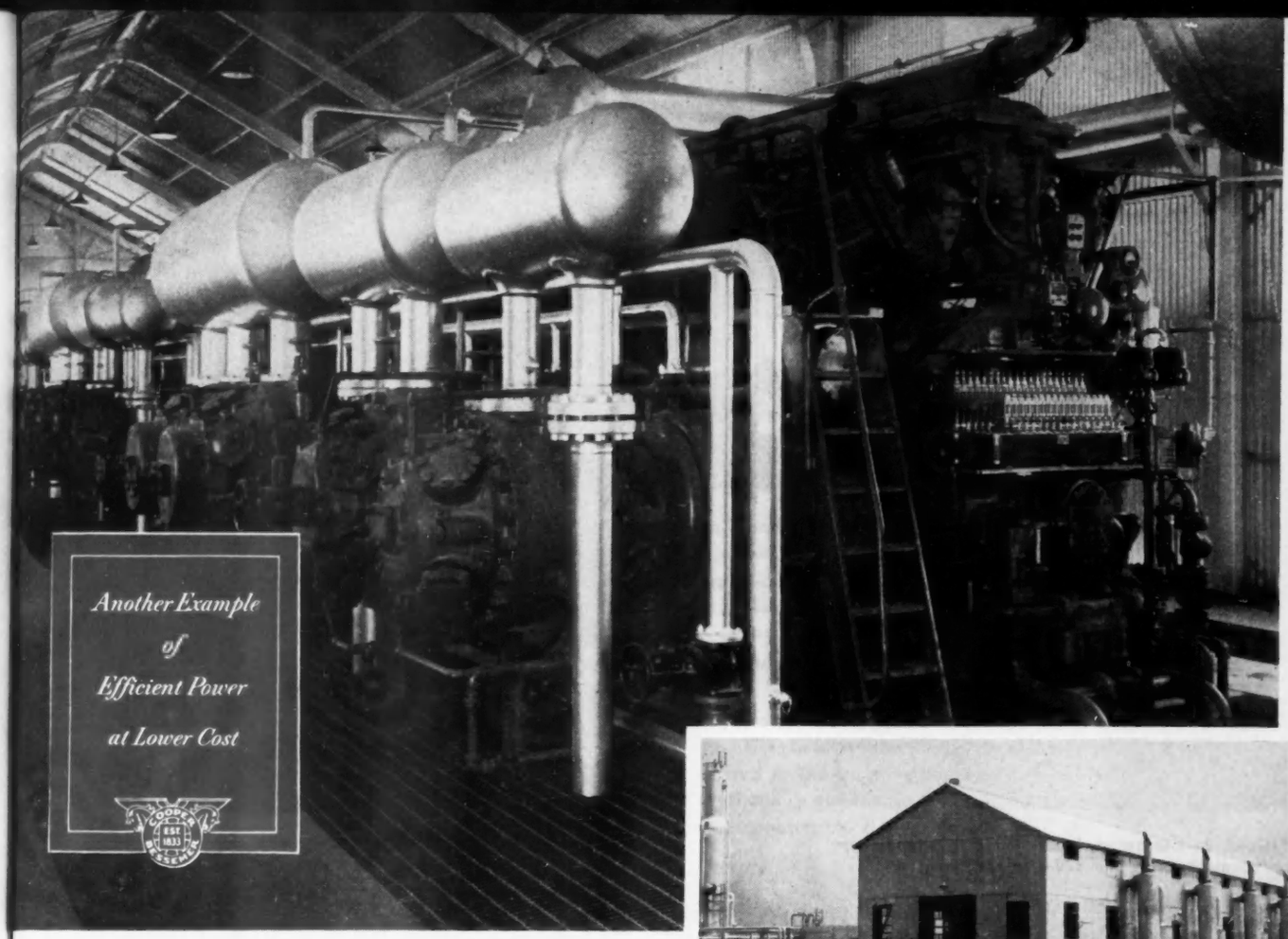
By C. D. BORLAND, JR., Gulf Oil Corporation, Roswell, N. M.

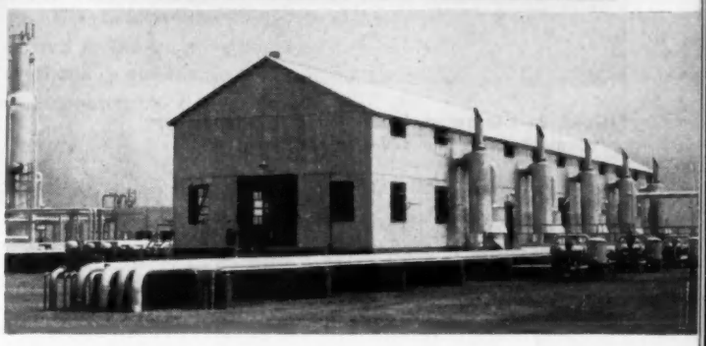
AVAILABLE DATA pertaining to development wells located in West Texas reflect a definite trend toward deeper drilling, with many of the new completions being deeper than 10,000 feet. With the advent of deeper drilling, numerous new drilling, completion, and producing problems have developed. One of the most difficult and expensive of these problems is the method utilized to artificially produce the so-called "deep wells," which, for the purpose of this article, will be classified as completions below 6500 feet. A brief review of the various types of equipment generally accepted and applicable to deep well pumping is presented, including:

1. **Sucker rod actuated pumps**
   - A. Conventional pumping unit—weight type counterbalance
   - B. Conventional pumping unit—air type counterbalance
   - C. Hydraulic pumping unit—long stroke
2. **Hydraulic pumping equipment**
   - A. Conventional type
   - B. Casing type
   - C. Free type
3. **Electrical centrifugal pump**

Sucker rod actuated pump. The principle of lifting fluid with a sucker rod actuated pump is older than the oil industry itself. Improvements and development of new equipment during the past ten years have aided in adapting sucker rods to deep well pumping.

The two main factors limiting deep pumping are the load capacity of the surface pumping unit and the physical properties of the sucker rods. These two restrictions have resulted in decreasing produced fluid volumes





Here, from the compressor cylinder side, is a line-up of modern Cooper-Bessemer GMVA's in Warren Petroleum's Saunders plant. The inset photo shows the neat, compact plant in which these five GMVA's are housed.

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FIGURE 2—Conventional pumping unit with air-type counterbalance and 120-inch maximum stroke.

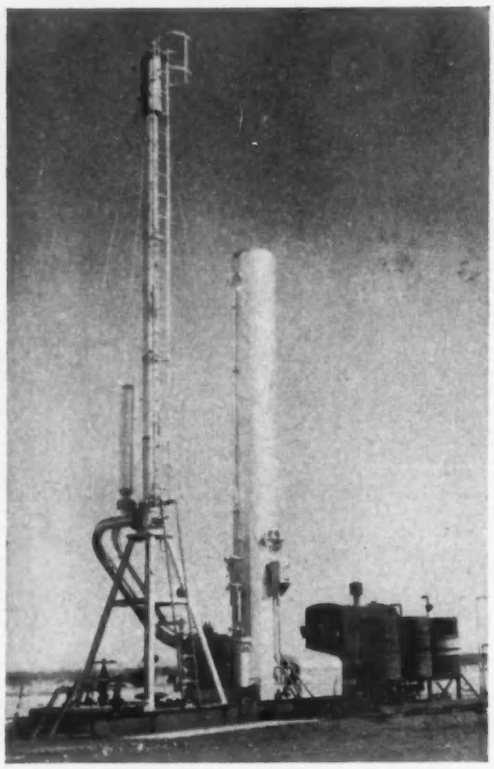


FIGURE 3—Hydraulic pumping unit with 20-foot maximum stroke.

as depth of lift becomes greater. In contrast, allowables generally increase with depth.

Several manufacturers have now developed conventional pumping units in the 30,000-pound polished rod load class with a maximum stroke of 120 inches. An actual polished rod load of this magnitude would imply a stress of 38,200 pounds per square inch on a one-inch sucker rod which would exceed the 30,000 psi limit ordinarily recognized for 4621 steel and would approach the 40,000 psi maximum recommended stress of the best rods now in use. On this basis, it can be safely stated that conventional pumping units of adequate size are available for handling loads equal to the limits now possible with the best quality sucker rods.

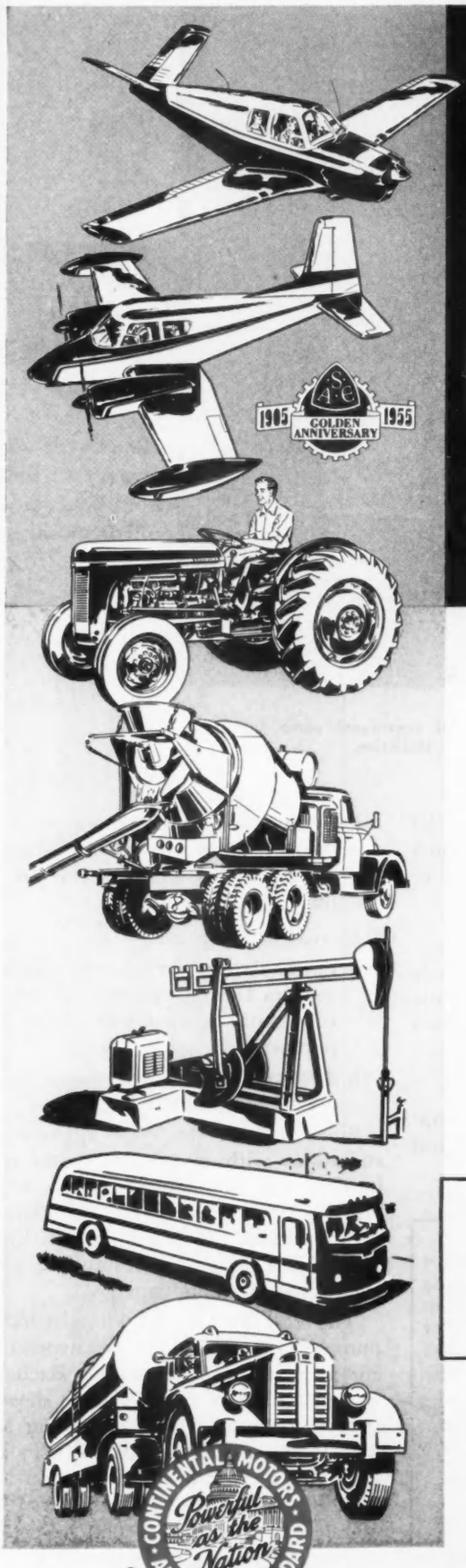
The operating strength of sucker rods is, therefore, the primary limiting factor when artificially producing deep wells. When designing subsurface equipment for such a well, considerable thought must be given to the size sucker rods and the bore of the pump to be employed. To illustrate, the weight of a 10,000-foot string of sucker rods of uniform size would exceed the maximum recommended stress of that particular rod size. This fact shows that complete rod strings of any one size cannot be utilized to pump deep wells.

The volume of fluid which can be lifted by sucker rods decreases with depth, because the bore of the pump must be reduced to lower the stress imposed on the rods. In addition, long sucker rod strings must be operated at relatively slow speeds to minimize peak loads due to acceleration. These combined factors result in decreased pump displacement when compared to that obtained with rod loads of the same magnitude in shallower wells. To compensate this loss in plunger displacement, manufacturers have designed long stroke pumping units to be operated at a few strokes per minute.

A. Conventional pumping unit—weight counterbalance. Conventional pumping units with weight type counterbalance were developed to replace obsolete rig fronts. Improvement during the past years has resulted in a compact piece of machinery that will give long and satisfactory service. The larger units with stroke lengths ranging from 74 inches to 120 inches and polished rod load ratings as high as 30,000 pounds are being used to pump deep wells. Several units with a maximum stroke of 74 inches and a beam rating of 25,000 pounds have been installed on deep wells in West Texas (Figure 1). Pumping depth has varied from 6900 feet to 8800 feet with installation costs ranging from $12,000 to $16,000 per well.

B. Conventional pumping unit—air counterbalance. Several companies are marketing a heavy duty pumping unit that differs from the conventional beam equipment in that air pressure, rather than weights, provides the necessary counterbalance. The main advantages claimed for the air balance type pumping unit by the manufacturers are:

1. Compactness of unit (resulting from mechanical construction).
2. Counterbalance easy to adjust (merely by increasing or decreas-



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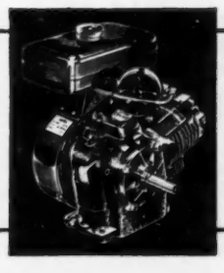

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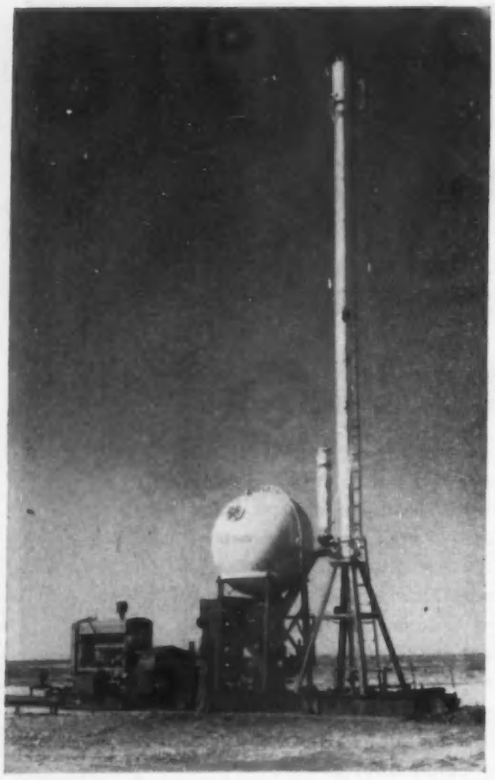

FIGURE 4—Hydraulic pumping unit with 30-foot maximum stroke.

FIGURE 5—Electrical centrifugal pump surface installation.

ing operating pressure of air balance system).

3. Vibration minimized (by elimination of large reciprocating or revolving counter weights).
4. Lower polished rod loads (lower acceleration loads obtained by placing the cranks that actuate the beam between the beam fulcrum and the well).

The air balance type pumping unit has been in service for many years in California, but is a relatively new item in West Texas. However, satisfactory operation has been obtained with pumping depths ranging from 8200 feet to 8600 feet.

The over-all expense of installing a 74-inch stroke pneumatic pumping unit on a 8500-foot well is approximately $17,000, which is comparable to the cost of a similar weight type counterbalance unit (Figure 2).

C. Long-stroke hydraulic pumping unit. The development of the long-stroke hydraulic pumping unit is one solution to the problem of attaining maximum plunger displacement while operating at the slow speed necessary with a long string of sucker rods.

The theoretical advantages of the hydraulic long-stroke pumping units are:

1. Increased sucker rod life
   a. Fewer reversals per minute.
   b. Reduced polished rod loads (cushioning effect of hydraulic system reduces rod stress when stroke reverses).
2. Increased production
   a. Possible use of larger bore pumps results from reduced polished rod loads.
   b. Reduction of fluid velocity through standing valve enables more complete filling of the barrel.
3. Increased pump life
   a. Fewer strokes per minute, which reduces frictional wear of bottom hole pump barrel and plunger.
   b. Reduced valve action should increase life of balls and seats.

Since most of the West Texas installations with which the writer is familiar are relatively new, data are not available to verify the manufacturer's claims. Published reports on the subject tend to substantiate at least some of the advantages.

The cost of installing long-stroke pumping units is, of course, dependent upon the size employed. Exclusive of tubing, available figures show that the complete cost of setting a 20-foot stroke unit on an 8000-foot well and a 30-foot stroke unit on a 10,000-foot well will be approximately $26,000 and $29,000, respectively (Figures 3 and 4).

Hydraulic pumping equipment. The use of a hydraulic power system to

Continued on Page 280

About the Author

C. D. BORLAND, JR., is assistant zone superintendent of production for Gulf Corporation at Roswell, N. M. He received his B.S. degree in Petroleum and Natural Gas Engineering from the Pennsylvania State College in 1937. Upon graduation, he was employed by Gulf as an engineering trainee at Seminole, Okla. Since 1937, he was served in various engineering and production capacities in Oklahoma, Kansas, Illinois, Texas, and New Mexico.

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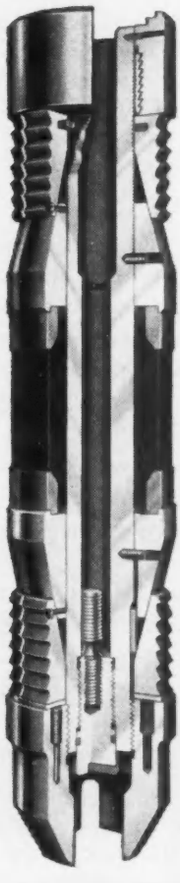

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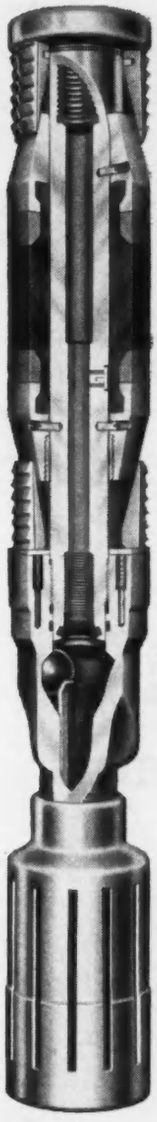

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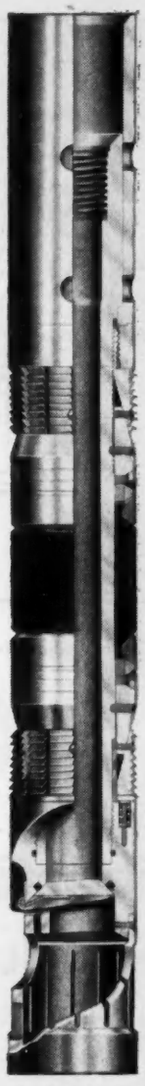

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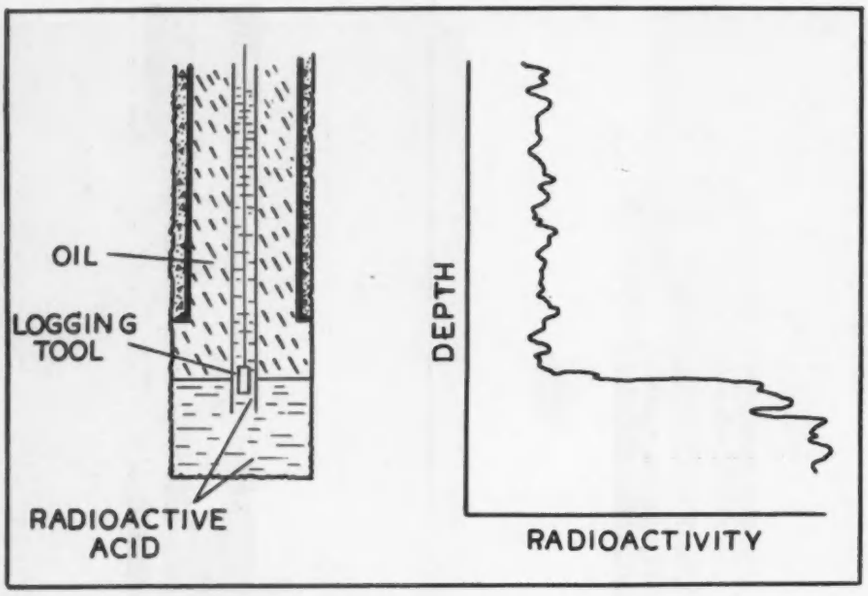


FIGURE 1—Use of radioactive solution to control acidizing, showing typical gamma ray log response during location.

Radioactive Tracers Solve Oil Production Problems

Versatile substance provides valuable information for drilling and production operations.

By L. F. TISCHLER, Manager, Tracerlab, Inc., Houston

RADIOACTIVE TRACERS have been used in the successful solution of production problems which had hitherto been considered difficult or impossible by use of conventional methods. Since 1946, the use of artificial radioisotopes by the petroleum industry has increased greatly.[1] One of the chief fields of isotope application has been found in the sphere of oil production.

Earliest applications of down hole tracers involved the use of the naturally radioactive uranium ore, carnotite.[2] Since this time, pile produced isotopes have become increasingly more available. From these isotopes may be chosen almost any combination of half life, radiation energy (reflected in the ability to penetrate cement, casing, etc.), and physical form (solid, liquid, gaseous).

Advantage of these isotopes is demonstrated by their low cost, ready availability, and high specific activity (for example, almost any amount of radioactivity may be incorporated in any given amount of carrier material). The high specific activity attainable permits easy handling, low shipment costs, and thus makes air shipments (for rapid availability) the rule rather than the exception.

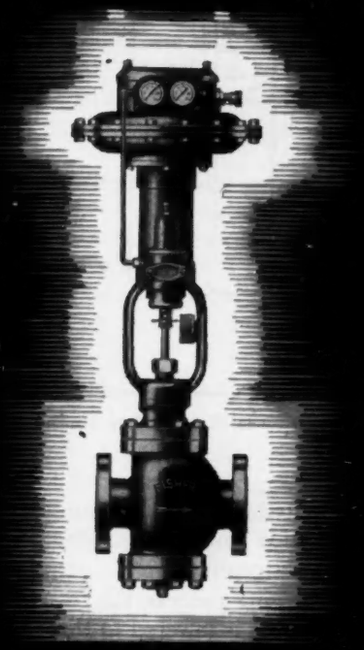
In many cases, mention is made of the use of radioactive iodine-131. The main advantage of I-131 lies in the fact that it has a half life (eight days) such that it decays relatively rapidly and permits future gamma logging without undue radioactive interference. Other isotopes have also been used successfully for down-hole studies. Radioisotopes such as silver-110, cobalt-60, iridium-192, iron-59, and antimony-124 have also been used.

Acidizing control and evaluation. Radioactive liquid tracers have long been used in the control of the acidizing operation.[3] The procedure is generally as follows: The tube through which the acid will pass is lowered to the bottom of the hole. The annulus between the tube and the casing is filled with oil. The acid containing a minute amount of radioactivity is then pumped down the tubing. The oil being lighter than the acid is displaced upward, forming a clearly marked interface between the two phases (see Figure 1).

A gamma detector located inside the tubing and opposite the upper level to be acidized is used to detect the radioactive material (insoluble in oil). If the radioactive acid arises in the annulus to be level of the detector, increased pressure on the annulus oil forces the acid level back downward. If the acid level becomes too low, then pressure is decreased on the oil in the annulus so the acid level is brought back to the proper height. Thus by varying the pumping rates of the oil and the acid, complete control can be obtained during the entire acidizing process, thereby minimizing waste of acid on non producing formations.

After completion of the acidizing process, a gamma log may be run on the well. Where the bulk of the acid has entered the formation, the log will show increased radioactivity. These "hot" zones are then identified as those areas which accepted the acidizing treatment.

Injectivity profiles. Liquid tracers are used to obtain a very accurate permeability survey of injection strata during a water flood operation. The first method described has been ex-



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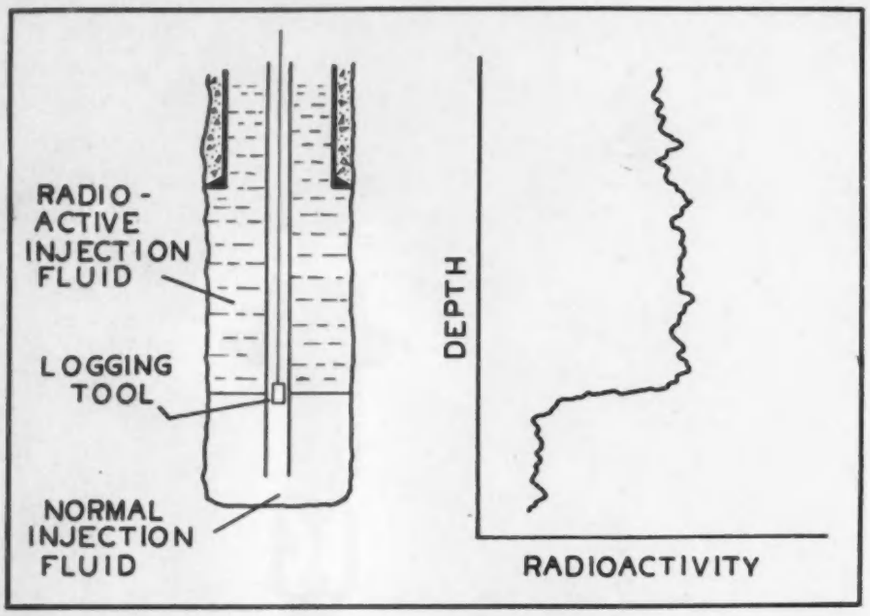

FIGURE 2—Radioactive solution used to control injectivity process and measure permeability.

tensively field tested,[4] and yields quantitative information concerning relative formation permeability.

As in the acidizing process, the injection water tubing is lowered to the bottom of the hole. This tubing carries the normal injection water. Radioactive solution (containing iodine-131) is then pumped down the annulus between the tubing and the casing (see Figure 2). During the permeability evaluation process, sum of the combined pumping rates of both pumps is kept constant. Starting with an annulus pumping rate of zero gallons per minute, the rate is increased by small increments while the tubing pumping rate is correspondingly decreased. As this process continues, the interface between the two solutions, which is marked by the lower limit of the radioactive solution, gradually progresses downward in the open hole. This movement is followed by use of a small gamma detector located inside the tubing. By correlation of the radioactive interface migration with the changes in pumping rates, a definite permeability may be ascribed to each zone under flood. This information may be further used to cement off the proper formations to obtain selective flooding and eliminate injection waste.

Another method which has been used successfully involves the introduction into the well of a slug of radioactive iodine solution.[5] Pumping is then commenced, and the downward passage of the slug is followed with a gamma detector. Activity of the slug decreases in proportion to the amount of solution pumped into the surrounding formations. Hence, the log showing decreasing radioactive content of the slug will indicate the relative porosities of the formations traversed.

Inter-well tracer. Water soluble radioactive materials have been tested for use as inter-well tracers during water-flood operations.[6] The liquid radioactive material is introduced in the injection well and the producing wells are monitored for the appearance of radioactivity. These data provide valuable reservoir information by indicating rate and principle direction of sub-surface movement, thereby establishing flow patterns. Channeling between wells also may be confirmed by use of this method. The amount of radioactive material used during injection is so dilute that the apparent permeability of the formations under flood are not changed by the presence of impurities.

Cement top location. Cement tops are clearly defined by the mixing of a few millicuries of radioactive material with the first few sacks of cement. Radioactive iodine in about a quarter pound of granular material is especially suitable for this purpose. Since the solid radioactive material remains with the cement slurry, a subsequent gamma log will reveal the exact location of the cement top. After a period of 6-8 weeks the iodine will have decayed to such a level that gamma logs again can be run without interference from radioactive contamination. The same procedure is applicable to squeeze jobs where radioactive iodine is mixed with the entire volume of cement. A subsequent log then reveals the exact results of the process by outlining the location of the cement.

Cement channeling. Use of radioactive material to determine cement channeling is as follows: A tube is lowered to the zone of interest and packers set above and below this zone. A radioactive solution is then introduced down this tubing and pumped through the perforations into the formation. After the well has been flushed, a gamma log is run on the zone of interest and compared to a base log. The appearance of any excess radioactivity above or below the packers indicates leakage of radioactive solution through the cement, thus indicating the presence and location of channels. The knowledge of the presence of channels is important in confining acidizing or fracturing to a definite zone and for sealing off formations which may be pumping undesireable amounts of water.

Casing seat channeling. The same method is used here as above, with the exception that only one packer is set near the bottom of the casing, above the injection point of the tracer. After pumping the radioactive solution into the open hole, the area is flushed and a gamma log taken. If any excess radioactivity appears above the casing seat it indicates leakage or channeling at that point. This method has also been used with questionable success in gas wells.[7] The tracer to be used in this case is a radioactive gas. The reference cited describes the use of radioactive argon-41.

Permeability surveys. Solid radioactive materials have been used to determine formation permeability.[8] The isotope in a very finely divided solid form is mixed with a large volume of water and the resultant slurry pumped down hole. The pumping rate should be chosen so that it will make negligi-

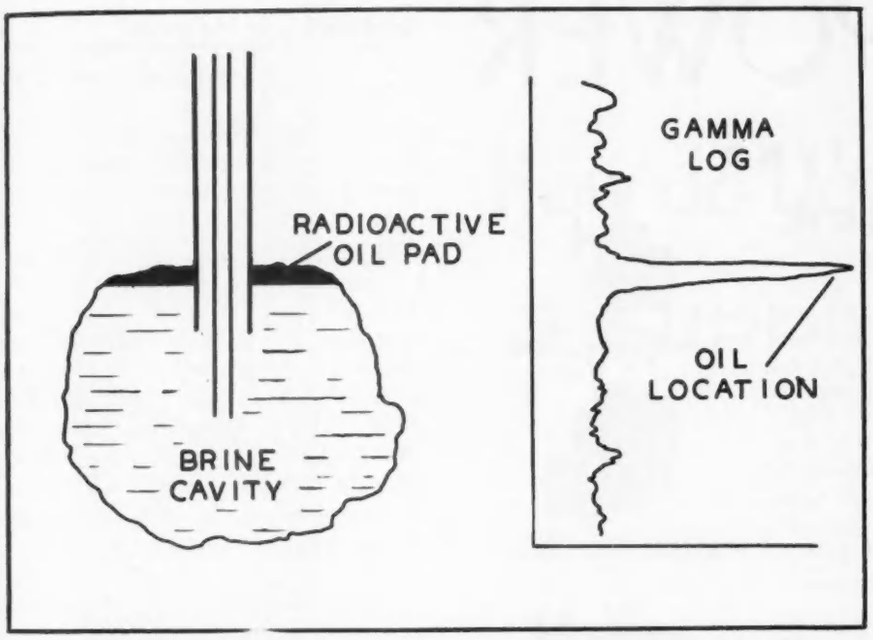

FIGURE 3—Location of oil pad in brine well by use of radioactive oil.

ble the tendency of the particles to settle by gravity. Since the radioactive material is dispersed uniformly in the pumped solution, formations which accept the most water will have the majority of the radioisotope plated on their surface. A gamma log then shows the most radioactive portions to be those areas of greatest permeability. In this case, as in many others, a reference gamma log should be run before introduction of the radioisotope. In this manner, the latter readings can be subtracted from the former in order to give a true permeability record.

Liquid radioactive tracers have also been used for this purpose and very accurate results have been obtained with their use.[4] This method can be used either in conjunction with oil injection or water injection profiles by the use of an oil soluble or water soluble radioactive material.

Casing leaks. For the location of casing leaks, solid particles containing radioactive iodine are used. Particles are chosen of such a size that they will not readily settle out of a water solution. The water solution containing the dispersed particles is then pumped down the well at a rate which exceeds the normal settling time of the particles. Since considerable water will leave the casing at the leakage points, solid radioactive material tends to accummulate at these points. A gamma log will then reveal the location and extent of such leaks.

Locating fractures. Radioactive iodine on solid particles may also be used to evaluate fracturing jobs. The radioactive material is added (about 10 millicuries in about one pound of granular material) to the last few hundred pounds of sand. The added tracer should be of the same mesh size as the fracturing sand. After the fracturing process has been completed, a gamma log will reveal the location of the isotope and thus define the location and extent of the fractured zone(s).

This process has been used with results ranging from questionable to good. Laboratory experiments are still in progress to develop a more generally applicable type of tracer for fracturing work.[9]

Lost circulation. When circulation is lost during drilling, the use of solid radioactive material has been used successfully for the location of thief zones.[10] A solid tracer of proper particle size is mixed with several gallons of mud and pumped down hole. During pumping, a continuous gamma log reveals the whereabouts of the tracer as it progresses downward. Thief zones may be identified by observing where the radioactive mud has a tendency to accumulate and enter the formations. This information is used for accurate placement of plugging materials in order to restore circulation.

Interface level in brine wells. The radioactive method has been used very successfully for the location of oil pads in brine wells.[7] The method (Figure 3) simply consists of pumping down a few hundred barrels of oil containing an oil soluble radioactive compound. Subsequent gamma logs show a high degree of radioactivity opposite the oil phase and no activity in the brine phase. Thus, the precise position of the oil pad, as well as the brine-oil interface, may be accurately located. This information is used to adjust the oil level to the proper position in the open hole.

Use to expand. Use of isotopes is expected to continue increasing due to: (1) more research devoted to this field, (2) demand by operators for more accurate downhole information, (3) increasing availability of radioisotopes, and (4) development of skills by field crews involved in the tracer processes and measurements.

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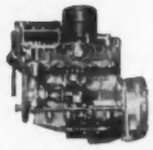

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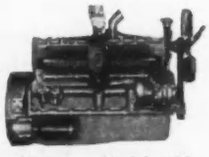

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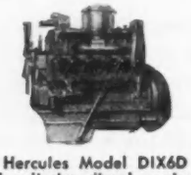
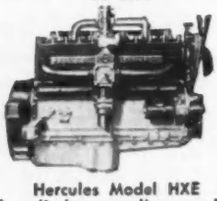
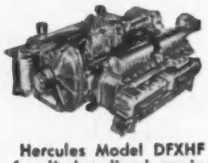
6 cylinder gasoline engine
112 H.P.



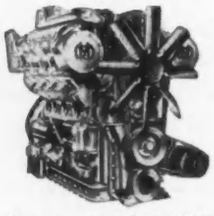
Hercules Model DIX6D
6 cylinder diesel engine
93 H.P.



Hercules Model HXE
6 cylinder gasoline engine
236 H.P.



Hercules Model DFXHF
6 cylinder diesel engine
260 H.P.



Hercules Model DNX-V8DTS
8 cylinder diesel engine
500 H.P.

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Artificial Lift Methods

Continued from Page 270

operate a bottom hole pump was one of the first methods of artificial lift that eliminated the use of sucker rods.

Several companies are marketing hydraulic pumping systems to produce oil wells. The bottom hole pumps offered by these concerns are similar in design and consist essentially of a piston-type pump with the engine end powered by crude oil pumped from the surface. All of the subsurface pumps demand clean power oil which usually requires a separate power oil tank and sometimes an expensive treating plant.

Three general types of hydraulic pumping systems are in common usage. The conventional or concentric installation requires that the bottom hole pump be run on small diameter tubing and seated inside a string of production tubing. Power oil and produced well fluid are pumped to the surface through the annular space between the two strings of tubing.

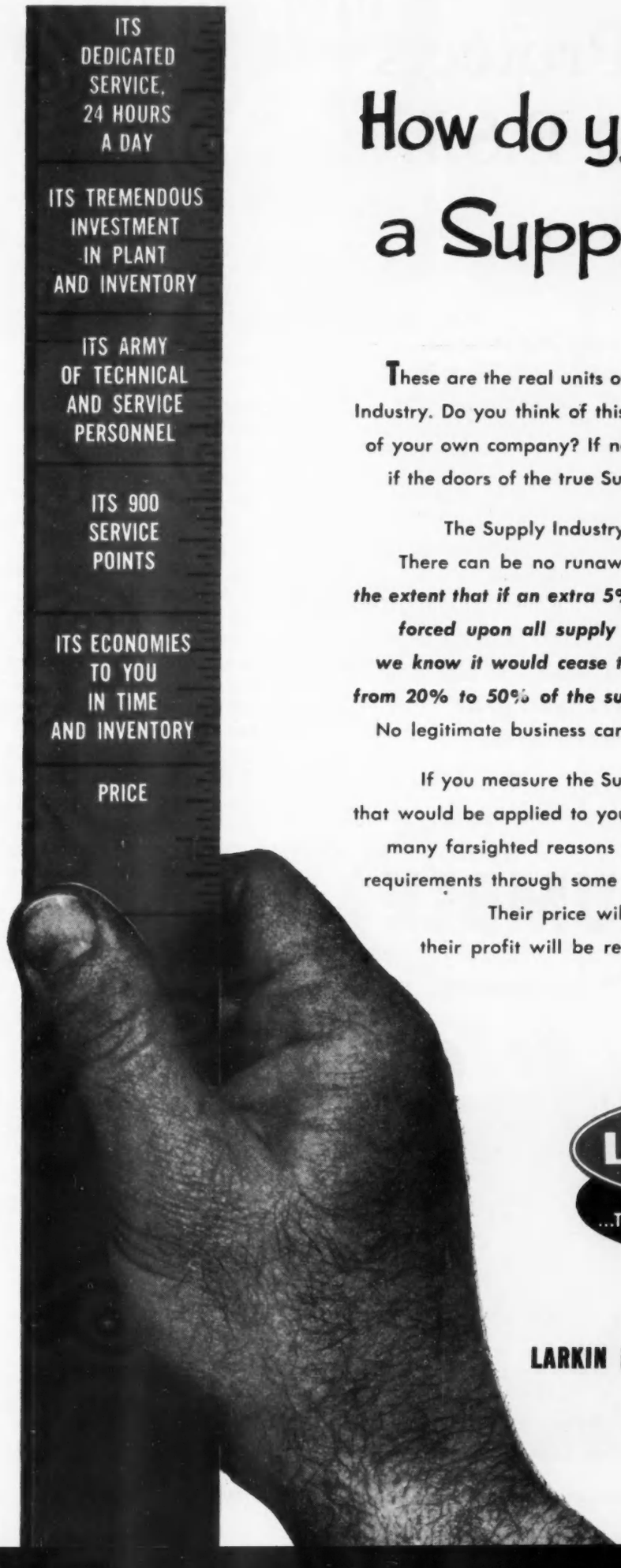
A casing-type pump requires only one string of tubing. The pump is run with a string of power tubing and is seated on a packer inside the casing. The power oil and produced well fluid travel to the surface through the casing-tubing annulus.

The latest development in hydraulic pumps is the free or retrievable type. The distinct advantage gained is that the pump can be circulated out of the well when replacement is necessary, thus eliminating expensive well servicing.

Cost data for hydraulic pumping installations vary considerably, depending upon the type of system, depth of well, and the number of wells to be equipped. The following examples of actual expenditures (for surface and subsurface equipment, including oil treating equipment) are shown for comparison only.

Type Pump	Depth	Cost
2-inch Conventional	10,568 feet	$23,500
4-inch Casing	8,000 feet	29,450
2½-inch Free	9,250 feet	29,070

Electrical centrifugal pump. Perhaps of more interest than the other methods of artificial lift is the adaptation of an electrically driven centrifugal pump to deep wells. The equipment, consisting of a submersi-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ITS ECONOMIES TO YOU IN TIME AND INVENTORY
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These are the real units of measure for what is truly the Supply Industry. Do you think of this great industry as an integral part of your own company? If not—think what it would mean to you if the doors of the true Supply Industry were to close tomorrow.

The Supply Industry operates within a limited markup. There can be no runaway prices. ***The markup is limited to the extent that if an extra 5% discount were suddenly to be forced upon all supply store sales, the Supply Industry as we know it would cease to exist. That 5% discount represents from 20% to 50% of the supply industry's gross profit on sales.*** No legitimate business can stand such a reduction in profits.

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their profit will be reasonable—and well deserved.

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In the oil industry, thread compounds must take punishing pressures.

Humble Thredkote will!

Thredkote is the trade name for the complete line of Humble thread compounds. Each is designed for a specific threaded connection.

Thredkotes prevent galling — reduce leakage and withstand extreme pressures.

FOR INSTANCE, Thredkote No. 703—for use on tubing in condensate wells — will take up to 2000 pounds per square inch pressure.

● *For full details on THREDKOTE types and uses, write Sales Technical Service Division or (in Texas) call your nearest Humble wholesale agent.*

HUMBLE OIL & REFINING CO.
Box 2180 Houston, Texas

HUMBLE

ble electric motor connected to a multi-stage centrifugal pump, is run on a string of tubing. Power is supplied to the motor by means of an insulated cable that is clamped to the outside of the tubing string.

One major operator in West Texas installed pumps of this type to artificially produce several wells completed in the Ellenburger formation at a depth of approximately 8000 feet (Figure 5). Average installation cost was $25,000 per well. Although the project was successful, a greater number of subsurface equipment failures were experienced than initially anticipated.

The score today. This brief review of artificial lift methods shows that sucker rod actuated pumps, hydraulically operated bottom-hole pumps, and electrically powered centrifugal pumps are being employed to produce deep wells.

Where sucker rods are utilized, long-stroke hydraulic pumping units are more adaptable to deep pumping than beam units. Weight and air balance beam equipment is less expensive but cannot provide the plunger displacement necessary to produce deep low fluid level wells.

Bottom-hole hydraulic pumps have proven to be satisfactory for lifting fluid from relatively great depths, with the free-type pump having the distinct advantage of eliminating expensive well servicing. Initial installation expense of a hydraulic system is comparable to the cost of a 30-foot long-stroke pumping unit. By utilizing a central power plant and treating system for a multiple well hookup, the "per well" cost is reduced appreciably below that required for individual long-stroke pumping units.

Electrical centrifugal pumps offer a satisfactory method for producing deep large volume wells; however, these pumps have definite limitations.

In the final analysis, long-stroke hydraulic pumping units and bottom-hole hydraulic pumps are best adapted for artificially producing most deep wells.

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[3] Design of Hydraulic Long Stroke Pumping Units, P. J. Donnelly, ASME Meeting—New Orleans, September, 1950.

—The End

ELECTRIC DRIVE LOWERS WELL-PUMPING COSTS

● With your wells equipped for electric pumping, you can have completely automatic pumping cycles.

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Texas Electric Service Company's oil-field specialists will be glad to study your particular pumping requirements and show you how they can best be met. For further information, get in touch with the nearest Texas Electric Service Company office.

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How to do it

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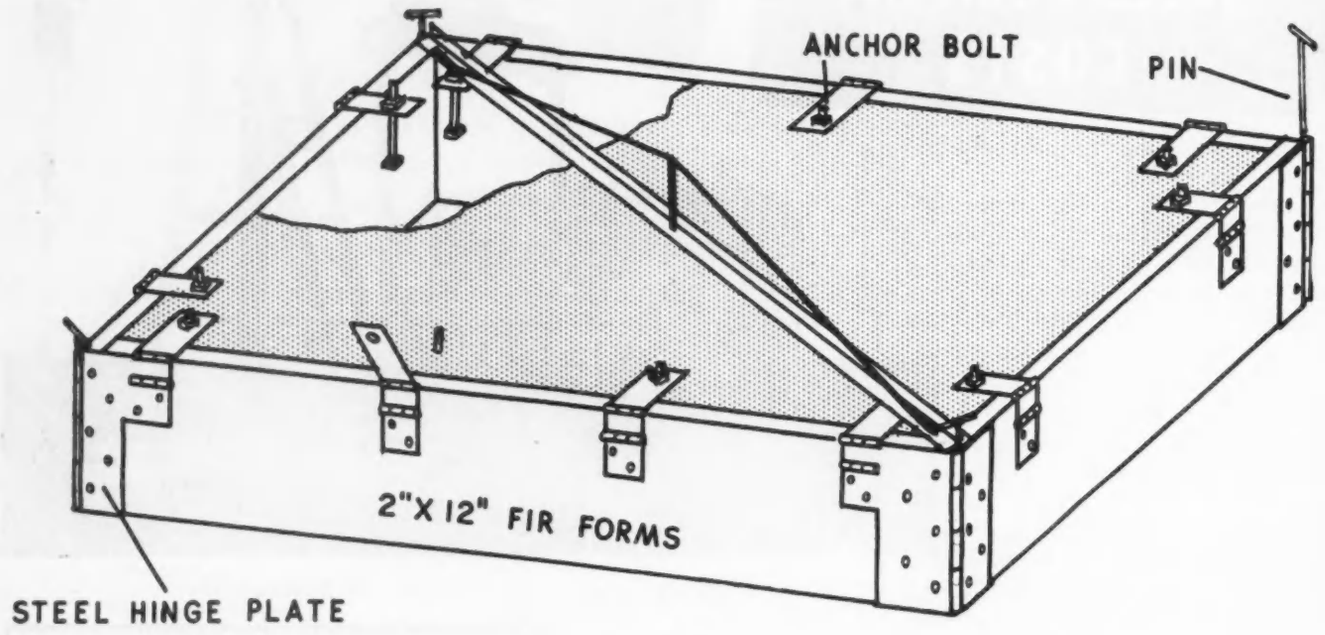
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



Make Form for Meter Building Slabs

A simple form saves $75 to $100 in pouring concrete slabs for meter buildings. The form is made of fir, hinged at the corners. A squaring bar holds the form rigid until the concrete sets. Corners are hinged with half-inch rod slipped through four pieces of half-inch pipe. Pieces of pipe are cut in varied lengths so that the sides can be put together in only one way.

Bolt jigs are double hinged as shown. This allows the hinges to be folded out of the way when the concrete is being struck off. Hinges fold back flat for neat stacking and hauling.

Forms are saturated with oil prior to use to preserve the wood and to prevent concrete from sticking. Some forms have been used over 50 times and are still in good condition.

Flow Line Safeguarded Against Excess Pressure

If lead lines from pumping wells tend to paraffin-up, pressure can become excessive in seconds. Wellhead pressure can go up into the thousands of pounds, causing flow line or tubing to rupture or tubing to part, in extremes necessitating junking of the well.

One company, when faced with this trouble in a problem well, installed a relief valve on the flow line. If wellhead pressure reached a predetermined figure, the valve would let the oil empty back down into the casing anulus, protecting flow line and tubing from excessive pressures.

On top of the tee at the end of the tubing head, they installed a limit switch to shut down the engine in case the relief valve failed. This switch was nothing more than a pressure gage with a ground line from the low tension circuit on the magneto running to a contact which grounds when the hand on the pressure gage touches it.

With these safeguards, the pumper could watch tubing head pressures and call in parrafin removal equipment when any higher than normal pressures were detected.

Call **UNION TANK** for CS&D units that...

RECOVER MORE

distillate...while dehydrating gas

You can recover 5 to 30 per cent more stock tank liquid than is possible with conventional separation, when well conditions permit the use of Union Cold Separation and Dehydration units. A large percentage of high-pressure gas wells have pressures, temperatures and well stream compositions that are economically ideal for CS&D operations.

Union CS&D units operate at much lower temperatures than conventional separation equipment, thus more hydrocarbons are produced as liquid. This increases both A.P.I. gravity and volume of fluid in the storage tanks.

The low temperature operation also reduces the water vapor content of the gas, making it ready for the transmission line.

Your Union Tank representative can assist you in determining whether your well conditions are favorable for a CS&D unit. Call today! And, ...

When your next well comes in, call Union Tank for fast, skillful service with dependable follow up on...

- Welded steel tanks
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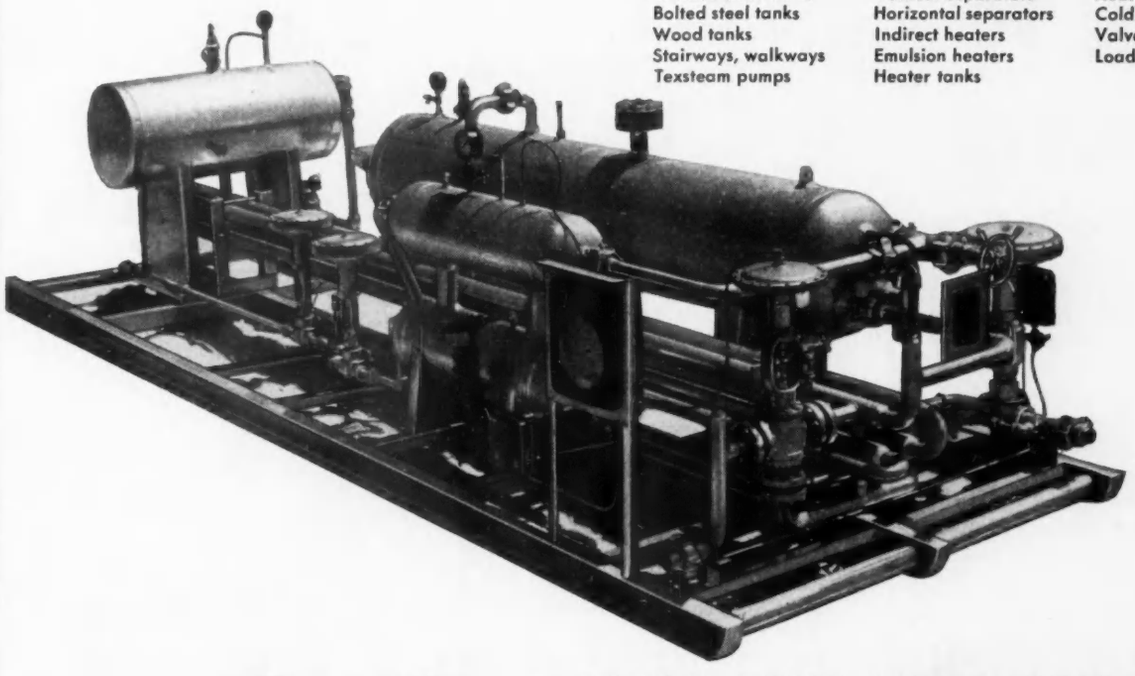

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DARCOVA valve cups are *the* truly texture-engineered cups that give you exactly the right composition for maximum pumping efficiency and cup life under varying conditions of depth, pressure, temperature, corrosion and abrasion.

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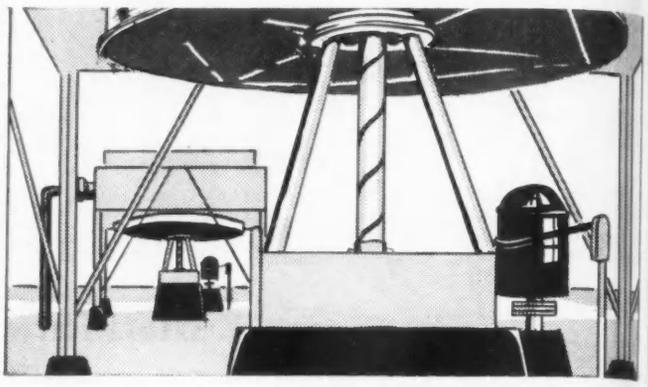
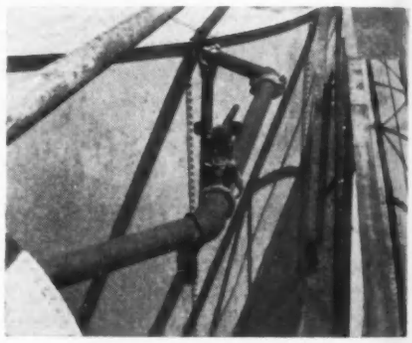
HINTS . . .

Painted Stripes Show Shaft Rotation



Paint a barber pole stripe on the shaft which drives the fan on air-cooled exchangers and make it easy for the operator to tell which units are in service. Ordinarily, the shafts are painted a solid color, and at a distance it is almost impossible to tell whether or not a fan is running. Just a few cents worth of black paint spiraled around the shaft in barber pole fashion solves the problem. Then, when the operator looks at the shaft, he immediately knows the fan is not operating if he can see the stripe. Otherwise, he knows that the unit is in service.

Tank Overflow Lines Provide Added Safety



Regardless of the conditions in the field, it is always desirable to have a margin of safety. Such is the case in the idea presented here. It is merely a 3-inch overflow line connected between 1000-barrel stock tanks.

Purpose of this line is to carry any overflow from one tank which is being filled into a second tank which is empty. Ordinarily, it is the job of the

THE WESTERN CHEMICAL FEEDER

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CHECK THESE FEATURES:

- **Used in Oil Well Water Flooding, Municipal Water Treating Plants, Canneries, etc.**
- **Can be driven by water entering plant for treatment.**
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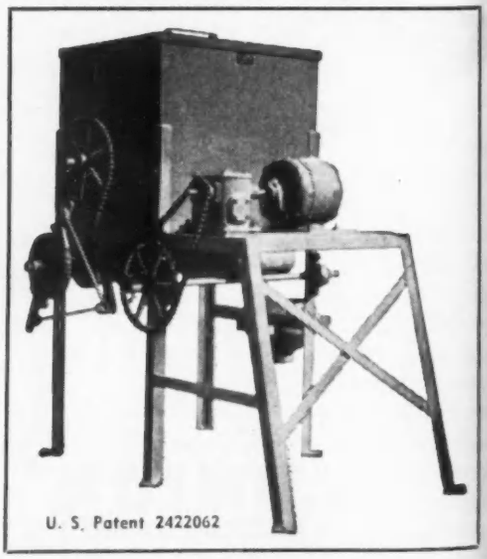

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For complete description see Page 2630 of the Composite Catalog.

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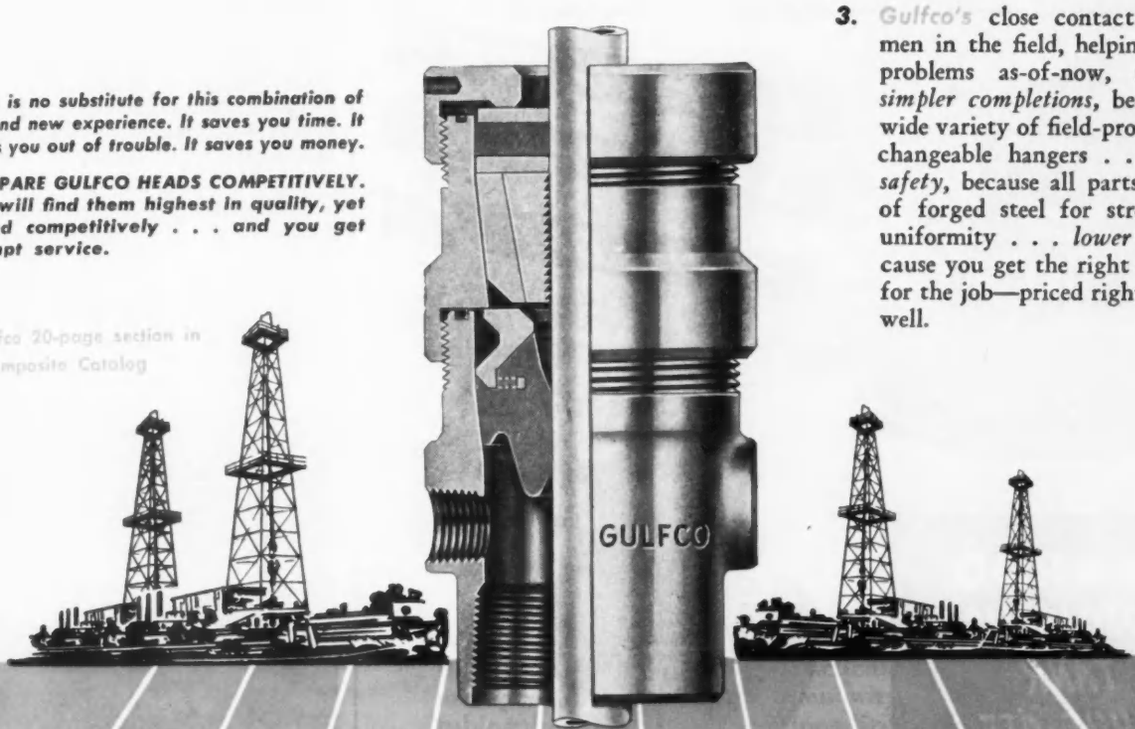
There is no substitute for this combination of old and new experience. It saves you time. It keeps you out of trouble. It saves you money.

***COMPARE GULFCO HEADS COMPETITIVELY.** You will find them highest in quality, yet priced competitively . . . and you get prompt service.*

See Gulfco 20-page section in Composite Catalog



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pumper to see that tanks do not overflow. Regardless of their vigilance, there have been numerous cases where tank overflow has occured.

Installations of this overflow line is simple. Flanged connections are bolted to the tank wall containing a hole large enough for this connection. By means of 45 degree elbows, the line is brought out near the cat walk, and connected with a quick-make coupling. A valve in the line makes it possible to shutoff any overflow action in the event that a test is made or for some special purpose.

Beam-Type Scales Measure Chlorine Added to Water

A beam type scale may be used to measure the amount of chlorine added to the plant water each day. Where around a quarter of a million gallons of water are passed each day, a drop of six to eight pounds in the weight of the cylinder will give a fairly exact reading. A comparator at the filters which is several hundred feet downstream from the chlorinator is used to determine the correct amount of chlorine to be added.

Using the regular bathroom or clinical type of scale, the cylinder will weigh approximately 265 pounds when full and approximately 90 pounds when empty.

This isn't exactly the problem we're referring to, but the need for an automatic shut-off valve can be just as drastic.

The Enardo tank shut-off valve is completely automatic. You can therefore eliminate those second trips to close the tank valves. When the pipeline valve is turned on, the Enardo shut-off valve locks in the open position. When the oil reaches a predetermined shut-off level in the tank, the valve will close automatically. Check valves are available in ALL models, saving installation of extra checks.

Stop wasting time and gasoline. Write Enardo today for further information about the Enardo automatic tank shut-off and check valve models.

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Risers Prevent Moisture From Entering Gas Line

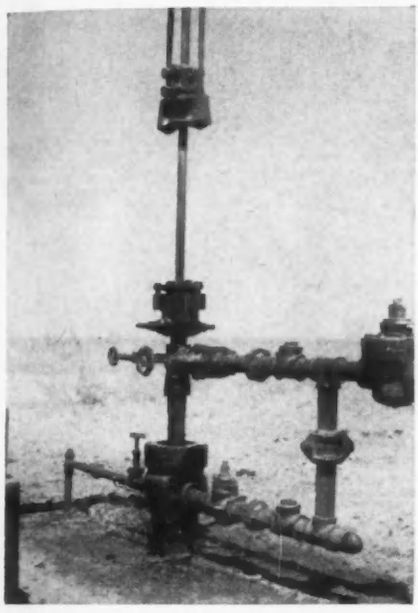
To keep casinghead gas, used for lease fuel, dry enough to give trouble-free operation of the pumping units, make a simple connection to the casinghead gas line. Put 10-foot sections of pipe on the outlets and mount the engine fuel regulator on the end of this "high and dry" line.

Lay the line leading from the casing head so that it will have a few inches fall as it passes the pumping engine and the outlet for other lease fuel. Install a back pressure valve on the end of this line to provide sufficient pressure on the fuel lines, yet

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

not enough to keep the oil from entering the well bore. Install the lease fuel line on the long riser without a regulator so that lease pressure can be carried a few pounds higher than necessary, to be reduced when needed.

Mount the regulator for the pumping engine at the top of its riser, and tie the gas back into the skid base of the engine which is made gas tight. This provides additional storage space and space for entrained moisture to settle out before rising to the carburetor.



Remove Casing Pressure During Fillup Period

When pumping wells are shut in during proration periods, oil tends to seep into the bore hole and fill up the well. This level may not be at the surface, but unless casing pressure is removed during this fillup period, the well will not fill up as much as it would if there were no pressure in the casing.

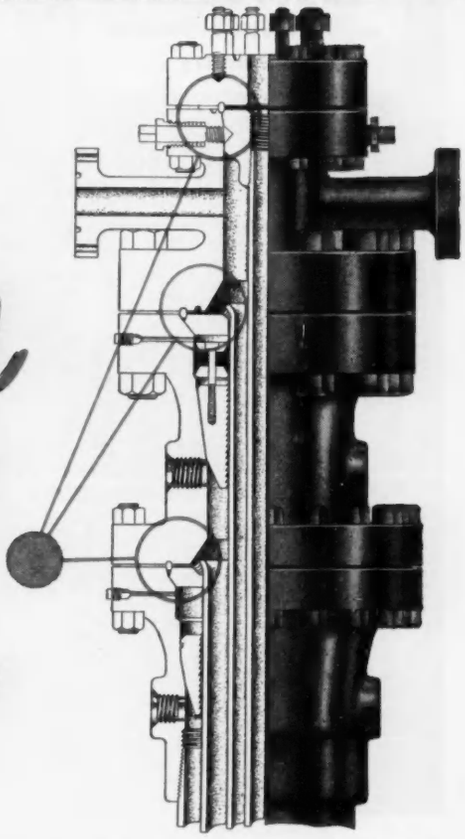
To relieve this situation, one operator connected his casing to the flow line as shown above. In addition, a small line was attached to the tree to supply the pumping unit engine with fuel.

When the well is shut down, any accumulation of gas within the casing can escape through the 2-inch line connected to the tree as shown. This practice permits maximum fill-up within the bore hole. During that time the pumping unit is in operation and it is desired to take gas from the casing for fuel, the 2-inch gas by-pass line can be shut off.

RECTORHEADS

Seal with Steel all the way

- for Safety
- for Permanence
- for Simplicity



Assembly of Type "RH" Rectorhead Casing Heads with three Casing Strings and Type "M" Tubing Head. Notice how welding ring seats in head body. API Ring Gasket completes the "seal-with-steel."

You wouldn't think of using soft packings between flanges or flanged fittings, particularly where temperatures and pressures are high. Then why use them in casing or tubing heads, where conditions are even more severe, and leaks more disastrous.

When you use Rectorheads you "seal-with-steel." The welded seals, plus API Ring Gasket, never require replacement or maintenance, will not "flow" under high pressure or temperature, will not "freeze" or contract under low temperature, will not burn out or deteriorate. The Rector Welding Procedure is covered in API Std. 6E., Third Edition, January 1952.

Why risk soft seals in your well heads when you don't use them in flanges? Specify Rectorheads and you can "seal-with-steel" between casing strings.

Sold through authorized Supply Stores.

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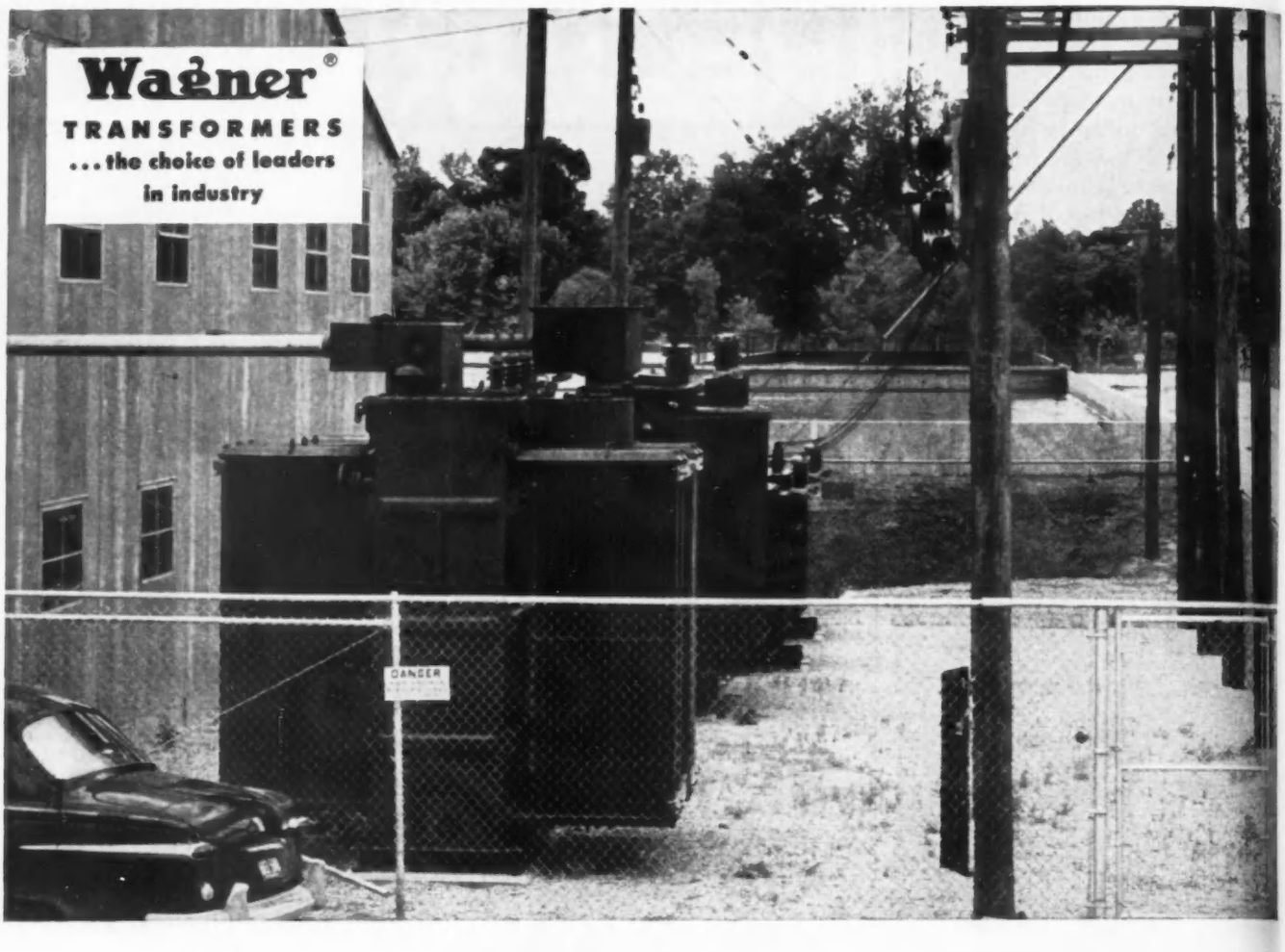

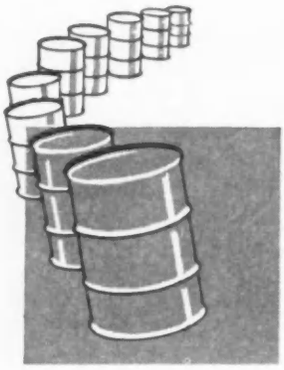

Trading Water for Oil

In Southern Illinois, over twenty oil companies have wells in the 10,000 acre Lake Centralia-Salem oil field. When production in this field dropped off, these companies banded together and decided to water-flood the field by pumping water underground through former oil producing wells to force more oil to move to the remaining wells.

What happened? The amount of oil produced has been greatly increased. Today, one well that formerly produced only 5 barrels of oil a day now yields 650!

Up to 130,000 barrels of water a day are pumped into the oil field, yet with the help of automatic devices and pushbutton control, the entire operation of the field takes only a handful of men. Electric power is at work, much of it supplied through the 2500 kva Wagner transformer, shown in the foreground above, that supplies power for equipment in the injection pump house.

Wherever electric power is used, Wagner transformers efficiently and dependably handle their never-ending job of supplying proper voltages for every purpose.

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Portable Safety Device Facilitates Tank Repair

Without proper equipment, it is sometimes difficult to provide adequate attention to tall vertical tanks and vessels, such as heater treaters. Here is a simplified personnel platform that can be suspended from the top of any tank. It is completely adjustable to any height desired.

This portable platform is made essentially from scrap material and has a base or floor plate which is somewhat moon-shaped. Adequate railing is built up to about four feet and three sections of half-inch chain connect from the top of this guard railing to the end of a wire line rope which is threaded through a pulley anchored at the top of the vessel to be repaired. A second pulley is anchored at the base of the vessel and the wire line, threaded through this second pulley, terminates at a winch on the roustabout truck.

By means of the truck winch, it is no problem to raise or lower the personnel platform to any desired height.

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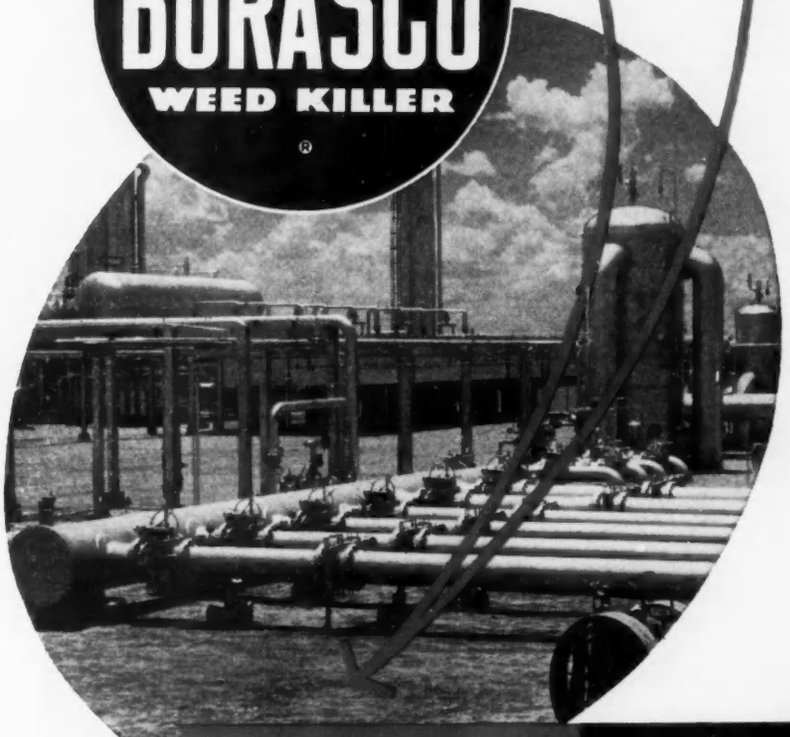

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a single application of Borascu Weed Killer may keep an area cleared for 1 or 2 years!

You won't know how easy it is to cut your "grassing" maintenance costs until you try Borascu! Then you may find, as others have, that your costs will tumble as much as 80%! That's because one speedy application of low-cost Borascu destroys vegetation and prevents its return for many months afterwards... with safety. Write today for literature and where to buy.

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HINTS . . .

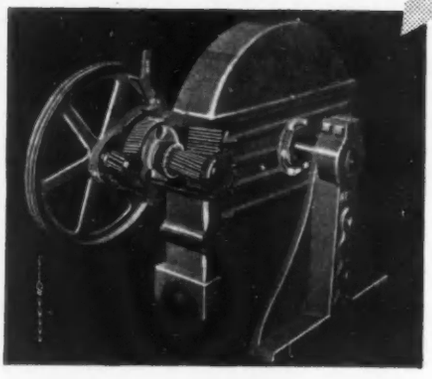
Place Heater on Flow Line To Stop Paraffin Trouble

In areas where crude oil must be heated to break down emulsions and paraffin accumulations, place a simple heater, fired with waste gas from the casing head, at each well. By placing the heat far from the tank battery, the desired effect will be accomplished without appreciable loss of gravity of the crude. The oil will be relatively cool when it reaches the tanks and the light ends will be re-absorbed.

Make the heater from a section of eight-inch pipe, welding in a flume so that it may be fired from the inside. Make the flume by welding an ell and collar in a short piece of 8-inch. Weld one end of the 8-inch piece shut and insert a joint of 4-inch inside it. Sew it up around the seam where the two 8-inch nipples meet. Cap the other end between the 4 and 8-inch. Make a burner from a 2-inch nipple inserted and welded in the center. An inlet at the bottom near the well, an outlet at the top on the tank battery side and legs complete the assembly.

This unit can be moved to various wells as they reach that period when it is difficult to treat the oil or when paraffin accumulations are common in the flow line.

JENSEN's Double Gear Reduction



. . . gives you SLOW pumping speeds with HIGH speed prime movers.

The JENSEN's Double Gear Reduction is an example of perfect engineering skill. It affords desired slow speeds with high speed prime movers. The second stage main gear is of large diameter, reducing tooth pressure to a minimum and providing flexibility of gear ratios found only in JENSEN JACKS.

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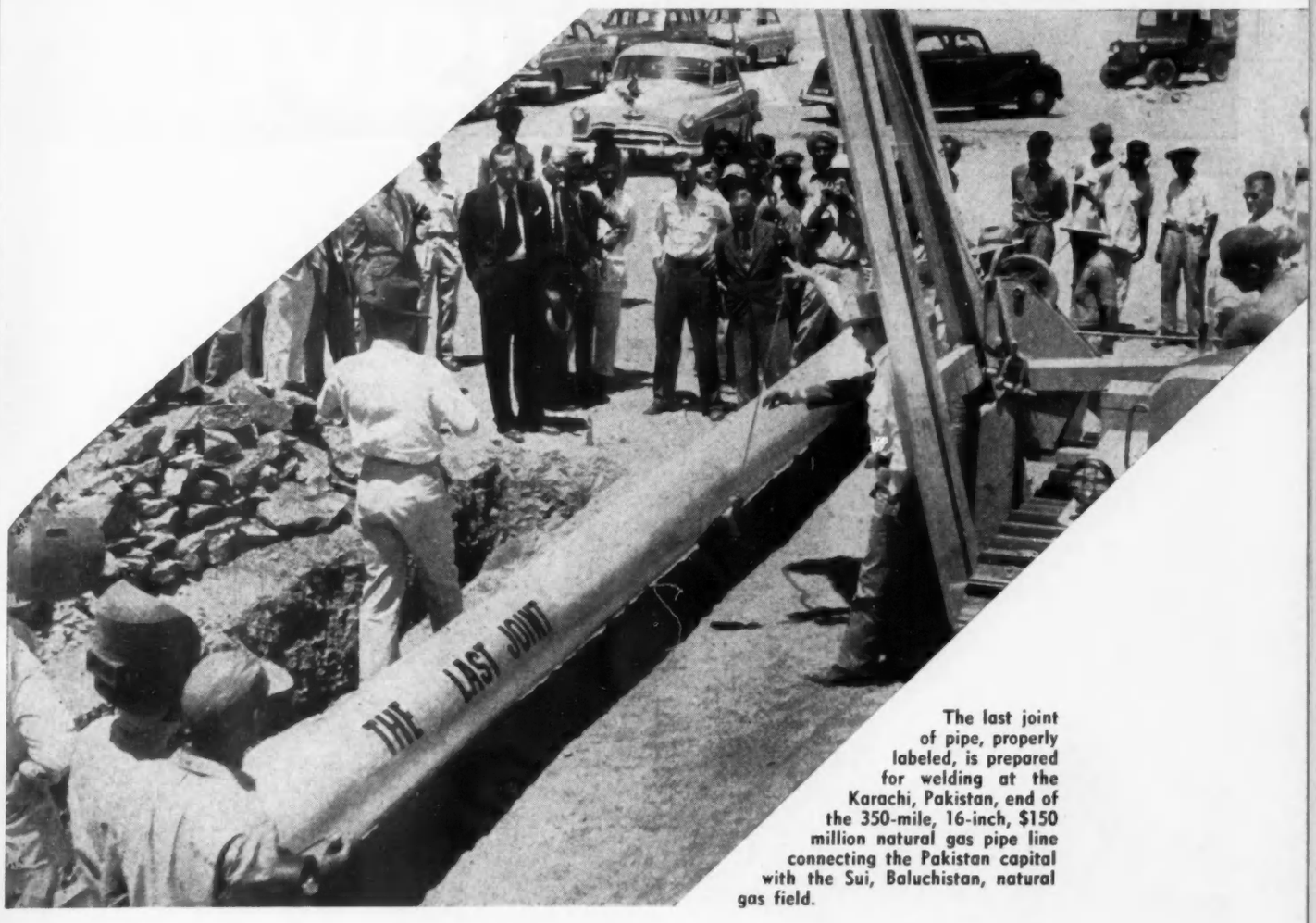
Wings Added to Wheel Aids Valve Handling

An added advantage was gained in opening and closing sticky gate valves by adding "wings" or handle extensions to the valve wheel as shown. After valves have been in field service for a number of years, they have a tendency to become difficult to operate. Sometimes the small hand wheel does not provide adequate leverage to open an old valve that has been closed for a long time, or to close it tightly.

To make it easier for field personnel to open and tightly close such gate valves, add extensions to the valve wheel. These extensions are merely short sections of 1¼-inch pipe welded to the valve wheel opposite each other and in the same plane with the wheel. When the pumper has to open or close these valves in a hurry, he can do so without the aid of a "cheater."



The last joint of pipe, properly labeled, is prepared for welding at the Karachi, Pakistan, end of the 350-mile, 16-inch, $150 million natural gas pipe line connecting the Pakistan capital with the Sui, Baluchistan, natural gas field.

The Last Joint . . . Pakistan will save millions of dollars now that a pipe line connects Karachi with the Sui gas field.

THE INITIAL STAGE of Pakistan's natural gas development program will occur in August when a large number of industrial plants at Karachi, the country's capital, switch over to the use of natural gas as fuel. Completion in April of the 350-mile, 16-inch, $150 million gas transmission line connecting Pakistan's industrial fuel deficit to the Sui gas field in Baluchistan will result in a saving of approximately $8 million in foreign exchange annually.

With an estimated average first stage consumption of 45 Mmcf a day, it is expected that the foreign exchange saving will increase to about $9 million annually.

The Sui-Karachi gas pipe line is unique in that it traverses almost every type of terrain, including swamps, deserts, rock, and green fields. At one stage of construction, 401 welds were completed in a single day.

It will be recalled that with the discovery by Pakistan Petroleum Ltd. of a large natural gas field in the Bugti Hills of southern Baluchistan at Sui, it became a matter of urgent necessity to make available this valuable source of indigenous fuel and raw material promptly and economically for industrial and agricultural development of Pakistan.

So the Pakistan Industrial Development Corporation and the Burmah Oil Company (Pakistan Trading) Limited promoted the Sui Gas Transmission Company Limited, which was incorporated last year.

The contract to construct the main pipe line was given to Pakistan Constructors, a partnership between Morrison Knudsen of the U. S. (75 percent) and William Press, of the U. K. (25 percent).

The first shipment of 16-inch pipe from London arrived at Karachi in August last year. Work began on November 2 and within 168 days the line had reached Karachi, thus averaging more than two miles of pipe per day under difficult climatic conditions. Sixteen hundred men worked continuously on the project, and on occasions the number rose to 5000 to expedite the work. The pipe line spans five rivers and more than 12 major canals.

Some discussion has been held on future plans, including a 350-mile pipe line to Lahore and possible tapping of natural gas supplies in southern Iran. Preliminary studies indicated the Sui field could supply a minimum of 115 Mmcf of natural gas daily for 60 years. —**The End**

EXCLUSIVE!

This is one of the first photographs of the first producing well in Bulgaria. The well is believed located in the vicinity of Rogatshevo. Bulgaria's first commercial crude was produced late in 1954.

First Authentic Photographs Of Bulgarian Oil Operations

By DON KLIEWER,
WORLD OIL International Editor

Bulgaria has joined the ranks of the crude-producing nations. Despite Russian secrecy surrounding the development, WORLD OIL obtained these authentic photographs of the operations and a brief description of activity leading to the discovery and progress made to date.

DESPITE RUSSIAN efforts to maintain rigid secrecy around oil operations behind the Iron Curtain, WORLD OIL has been reliably informed that Bulgaria is now a crude-producing nation. After four years of geological and geophysical operations, the first series of wells drilled in December, 1954, and January, 1955, are reported to have discovered modest-sized crude deposits in the vicinity of Rogatshevo. Soviet supervisors of mapping operations have turned over their files to Russian field engineers, who are operating Russian and Rumanian drilling equipment.

Thus, Bulgaria has become the youngest of all oil producing countries. So far four wells have been drilled. Equipment for each drilling rig includes five Russian diesel engines. Two types of drilling rigs are being used: the "Bu-40" from Russia and the "First of May" from Rumania. Sofia reports indicate that one rig of each type was used for the first two wells. Two Soviet rigs were used for the third and fourth wells. A fifth rig, also a Russian product, arrived during February at the drilling site which was not disclosed.

The nation's first crude was commercially produced during the last two months of 1954. As a result of this new-found source of petroleum, Bulgaria's first refinery is currently under construction near Varna. With an annual throughput capacity estimated at approximately 2.5 million barrels, the refinery will include distilling equipment shipped in from Baku, a Russian oil producing region, and a cracking plant manufactured in East Germany.

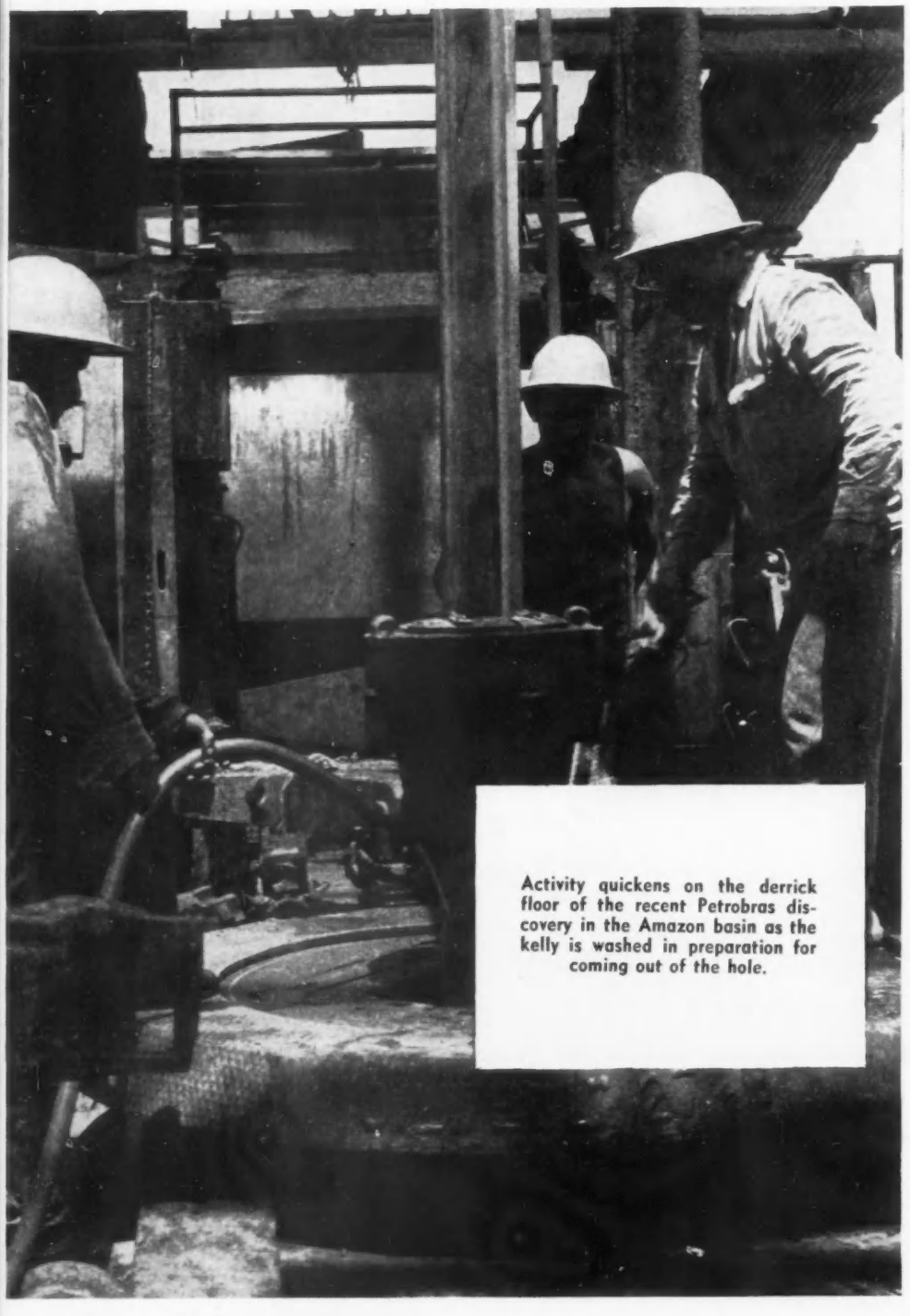
WORLD OIL has learned that Russia expects to have the refinery on stream by the end of this year. Initially, imported crude, probably from Rumania, will be processed at the new refinery. An increasing percentage of domestically-produced crude from Bulgaria's new field will be channeled into the new plant.

This Russian-made tractor is operating in the Bulgarian oil field. In the background are two Russian derricks. Four wells have been drilled in Bulgaria. Equipment for each drilling rig includes five Russian diesel engines.

—The End

Petrobras to Push Amazon Tests

Offsets to recent discovery well planned. One of eight new drilling rigs ordered from U. S. scheduled to commence operations soon in Nova Olinda area. Possible oil province can bolster Brazilian economy.



Activity quickens on the derrick floor of the recent Petrobras discovery in the Amazon basin as the kelly is washed in preparation for coming out of the hole.

By DON KLIEWER,
World Oil International Editor

Petroleo Brasileiro, S. A. (Petrobras) is planning to drill offsets to its recent Amazon basin discovery well 1-AZ (World Oil, May, 1955, Page 231). The well reportedly is producing 250 barrels of 40.9-gravity crude daily from 8917-9002 feet. It was not indicated when the discovery well would go into production. But it was scheduled to undergo further tests late in April.

The discovery, referred to as Nova Olinda because of its proximity to the town of that name on the Madeira river about 75 miles from Manaus, was completed in carboniferous sandstone. The well produces through 2½-inch tubing set inside 5½-inch casing. The diesel-powered rig used by Drilling and Exploration Company, Inc., is capable of drilling to 15,000 feet. Nine hundred cores were made on the discovery well.

Transportation of crude from Well 1-AZ will offer no difficulties since it will be moved to the east coast by Amazon river tankers. Should further development drilling result in only small production, the crude probably will be refined in the 5000-barrel-a-day government refinery at Mataripe in Bahia. If major production develops, the crude may be transported to another government-owned refinery—the 45,000-barrel daily plant at Cubatao, which recently went on stream.

The Cubatao refinery is supplied now with Venezuelan crude from a

distance approximately the same as that which the government's own Amazon crude would travel.

Brazil's total refining capacity is 86,800 barrels per day, with more than half that amount being refined in government plants. Five private refineries have a total throughput capacity of 36,800 barrels a day. Cia. Petrol. da Amazonia, a private firm, is constructing a 5000-barrel-daily refinery which will operate on imported crude. Only the government's Mataripe refinery handles domestic crude.

The Amazon discovery, a result of seismograph study, opens up a new and possibly extensive oil province which, if only a portion contains petroleum, will bolster Brazil's economy and reduce its growing purchases of crude from outside the country.

Such a wide area for petroleum development would offer Brazil a chance to cope with its burgeoning consumption of petroleum products and to preserve its future foreign exchange position.

By 1957 the nation's total consumption of petroleum products is expected to reach 211,500 barrels a day—amounting to $292,400,000—a 277.7 percent increase from 1947 consumption of 56,000 barrels per day—worth $81.9 million (See Table 1).

In Brazil, it is felt that if the Amazon basin discovery proves a major crude reservoir the nation could become self-sufficient in petroleum within 15 years, even though demand will have increased considerably.

Petrobras has speeded its efforts to continue testing the Nova Olinda region. Eight drilling rigs were ordered recently from the U. S. One of the rigs, whose arrival in Brazil was expected soon, was to be put into operation immediately at Nova Olinda.

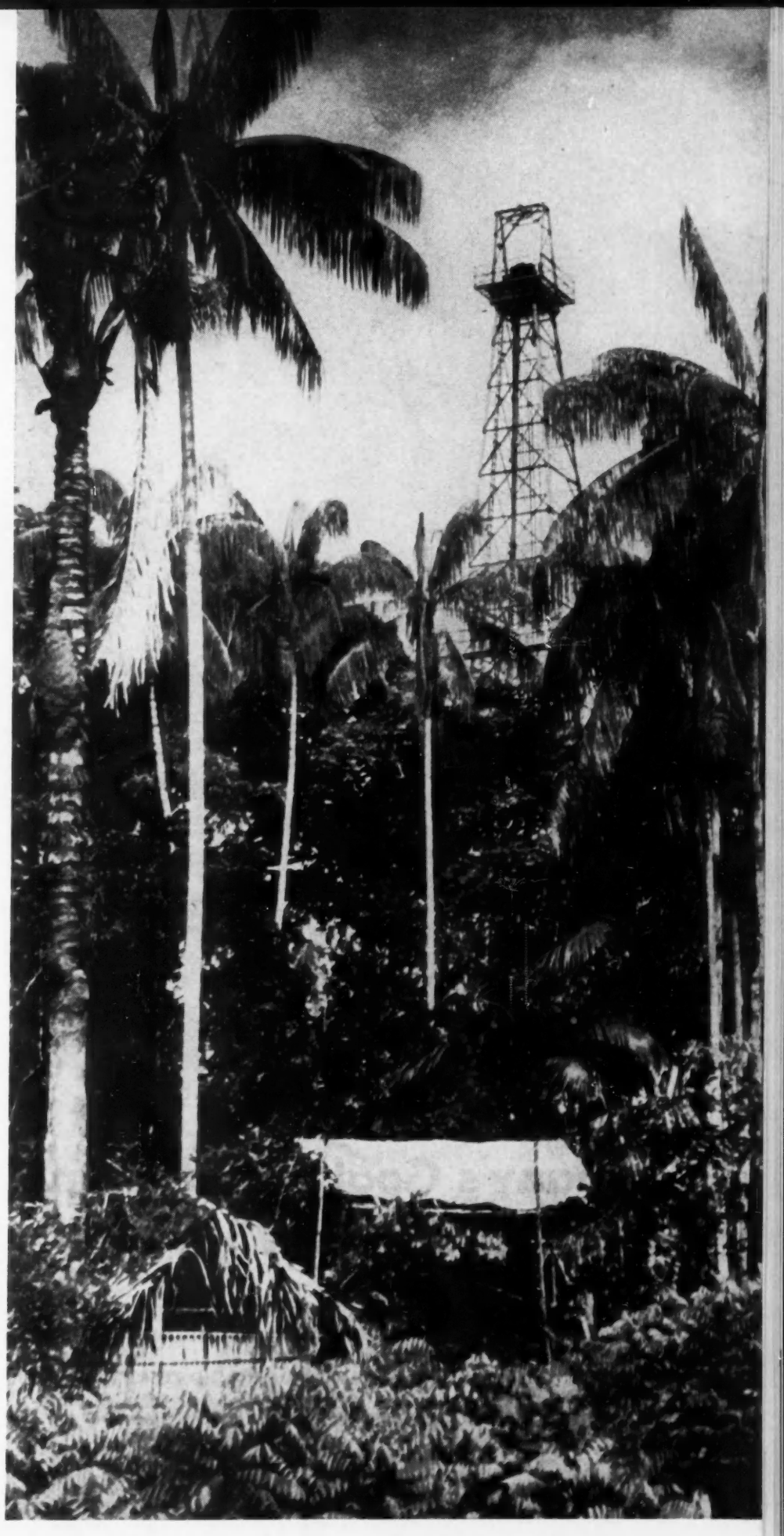
TABLE 1

Consumption and Value of Petroleum Products in Brazil*

YEAR	Petroleum Products (Bbls. Daily)	Value
1947	56,000	$ 81,900,000
1948	64,000	117,400,000
1949	76,000	120,200,000
1950	92,000	146,700,000
1951	109,000	222,200,000
1952	128,000	254,900,000
1953	143,000	245,900,000
1954	163,000	264,700,000
1955*	180,000	206,800,000
1956*	196,000	247,700,000
1957*	211,500	292,400,000

* 1955-1957 estimated.

—The End



Towering above the Amazon jungle is the top of the Brazilian discovery well. Located near the town of Nova Olinda on the left bank of the Madeira river, the wildcat is a 250-barrel-a-day producer.

Pumping wells in the old Wietze field in northwestern Germany.

Germany's Goal: 25 Million Barrels of Oil in 1959

German Producers Association forecast is supported by estimate of proven and probable reserves of 464 million barrels at beginning of 1955.

By A. M. STAHMER

CRUDE PRODUCTION of West Germany, which reached almost 19 million barrels in 1954, will exceed 25 million barrels in 1959, according to a forecast of the German Association of Oil Producers. This prediction is supported by a recent estimate of proven and probable underground reserves compiled by the German Geological Survey in cooperation with oil companies.

According to the GGS estimate, total reserves, which amounted to 390 million barrels at the beginning of 1954, increased to 464 million barrels during 1954, despite 1954 production.

The remarkable rise of estimated reserves should not lead, however, to the conclusion that the high percentage of increase will be continued indefinitely. It seems more probable that the hitherto steeply rising production curve will slacken. Also, according to the Producers' Association forecast, the rate of increase will subside more and more, i.e., from 15 percent in 1955 to no more than 2 to 3 percent in 1958 and 1959.

The oil search in Germany experienced a sort of boom in the last three or four years.

- Deep structures between various Hanoverian salt domes—Suderbruch, Eldingen, Hohne, and Hankensbuettel—were explored.

- The link was found between Emsland and Hanover oil provinces by development of the new production district between the Ems and Weser rivers.

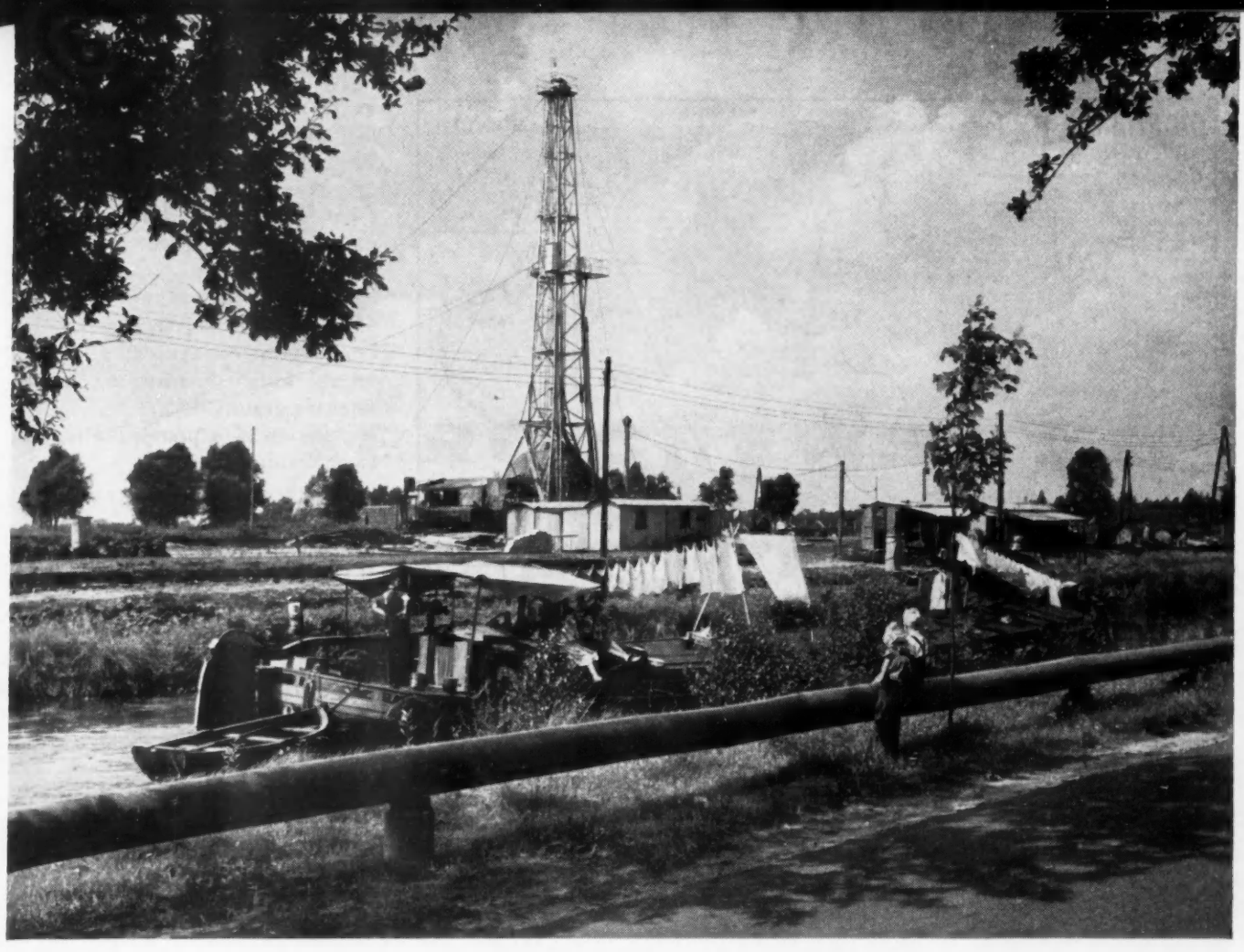
- In Middle Holstein several fields were discovered on the northwestern edge of the Hamburg basin.

- In the middle of the Rhine Valley graben some structures proved oil-bearing.

- The long lasting investigations in Bavaria resulted in oil and gas discoveries east of Munich.

In Northwest Germany, which continues to yield the bulk of the nation's oil output, geologists are trying to find promising new projects for future exploration drilling. Geological studies have proved that further prospecting activities must be limited as a rule, to the borders of the Jurassic troughs. Therefore, extensive areas must be considered uninteresting for future investigations.

Two exceptions, however, must be considered: the deep Zechstein formation in northwest Germany and the



Rig operating in the moor area of the Emsland oil district in the Ruehlertwist field.

Molasse basin of Bavaria which covers an area of about 13,000 square miles.

There appears little doubt that oil and gas finds of Ampfing, Isen, Steinkirchen, and Schwabmuenchen made in this basin during the past 12 months mean the beginning of a development by which Bavaria may become an essential factor in West Germany's crude production.

Bayerische Mineral-Industrie, an affiliated company of Socony-Vacuum Oil Company, started the first geophysical investigations in East Bavaria (Inn-Quarter) in the 1930's. At that time, some deep holes were drilled which, however, did not strike oil but (near Fuessing) mineral springs. On the strength of thorough reflexion seismic investigations carried out after the war, wells at Ampfing and Isen were located, which in January and May, 1954, resulted in the first oil and gas finds on these structures situated 40 and 25 miles east of Munich, respectively.

Production tests at Ampfing yielded a daily output of about 4 Mmcf of natural gas through a ⅓-inch choke.

Estimated German Crude Oil Reserves As of Jan. 1, 1955
(In Barrels)

	Proven	Probable	Total
Holstein-Hamburg	27,512,500	14,910,000	42,422,500
Hanover	117,787,580	43,693,400	161,480,980
Weser-Ems District	49,636,100	25,986,000	75,622,100
Emsland	137,030,000	38,340,000	175,370,000
Upper Rhine Valley	4,146,400	3,621,000	7,767,400
Bavaria	710,000	710,000	1,420,000
Total	336,822,580	127,260,400	464,082,980

German Crude Oil Production in 1954, Compared with March, 1955
(In Barrels)

	Total 1954	March, 1955*
Emsland	7,317,296	658,532
Weser-Ems	2,264,857	251,049
Hanover	6,995,822	647,343
Holstein-Hamburg	1,863,352	190,294
Upper Rhine Valley	487,351	47,215
Bavaria	2,201	3,010
German Total Production	18,930,879	1,797,443

* Preliminary figures.

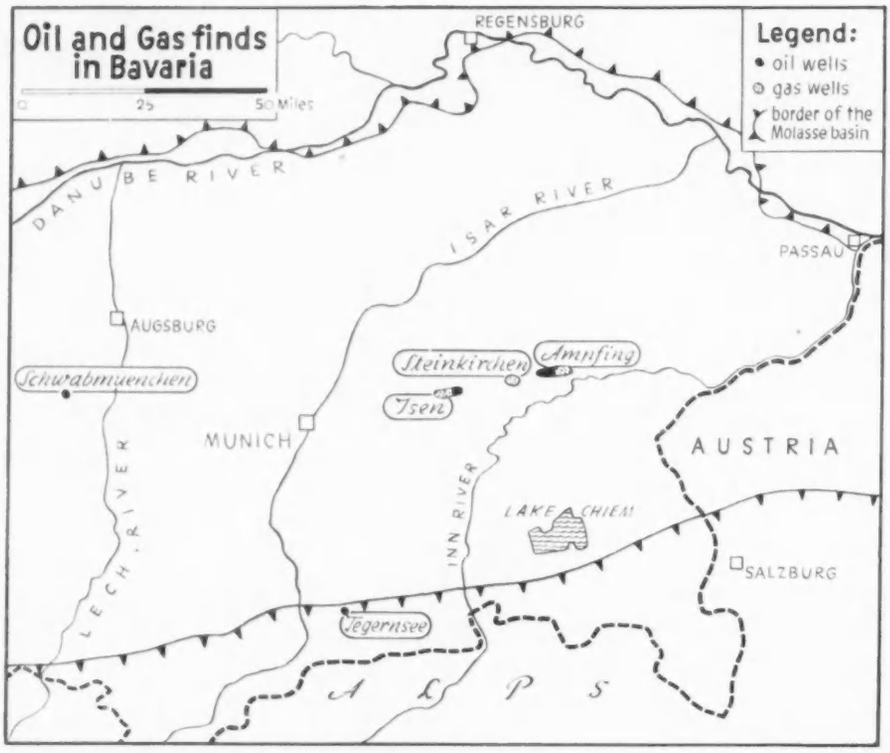
German Natural Gas Production 1954
(In Millions of Cu. Ft.)

Gas Fields		
Bentheim	1,440	
Itterbeck-Halle	914	
Frenswegen	428	
Rehden	227	
Pfungstadt	85	3,094
Gas recovered from oil fields		2,207
		5,301

Further down dip, oil impregnated sands were encountered at the base of the Tertiary at depths between 5900 and 6000 feet. These sands delivered about 70 to 100 barrels of good quality crude per day through a ⅛-inch choke. Particularly notable is the flat dip of the strata, justifying the hope of a large gas- and oil-bearing zone at Ampfing.

Production tests carried out in the first successful well of Isen field, which is situated farther west, likewise yielded a flow of about 4 Mmcf of natural gas daily through a ⅓-inch choke. Another well, which was located two miles farther east, delivered some heavy crude from a depth of about 6600 feet. In March, 1955, Steinkirchen 1 of Deutsche Vacuum Oel AG.-BMI, situated between Ampfing and Isen, struck gas at a depth of about 5500 feet, in the same horizon which was gas-bearing at Isen. Preliminary production tests yielded about 2.5 Mmcf of natural gas daily through a ¼-inch choke.

Farther west, oil was discovered near Schwabmuenchen, south of Augsburg



New Oil Fields in Northwest Germany

in the middle of March, 1955. An exploration well in which Gewerkschaft Brigitta (Shell and Standard Oil Company [of New Jersey]), Gewerkschaft Elwerath and Wintershall AG participate, found good oil and gas traces in three horizons of the Molasse basin at depths between 4200 and 4500 feet. The lower and the middle horizons were tested and flowed several cubic barrels of crude oil (specific gravity 0.835) per day. After installation of a pump, the tests were to be continued.

Whether it will be more economical to produce gas or oil, or both, at Ampfing and Isen has not been determined. As soon as it is decided to recover oil, the problem of refining the crude will have to be solved because the nation's refining industry is almost 100 percent concentrated in northwest Germany and rail freight to the north is uneconomically high. In the reserves estimate as per January 1, 1955, the Geological Survey for the first time listed a quantity for Bavaria which at 1.4 million barrels was calculated conservatively.

Compared to the year before, reserves of the old Hanoverian oil province were put considerably higher by about 35 million barrels. This was due primarily to the promising discoveries of Hankensbuettel and Oerrel-Sued, where Dogger (Jurassic) horizons with good oil impregnations were found in a stratigraphic trap position at depths between 4500 and 5300 feet. The output of Hankensbuettel and Oerrel-Sued together, which belong mainly to Deutsche Erdoel-AG, reached 450,000 barrels in the year of their discovery.

Some discoveries of apparently minor importance were made in the southern part of Hanover near Brunswick—Ruehme, Meerdorf, and Vechelde. The Ruehme structure, too, constitutes a stratigraphic trap, while Vechelde deposit is bound to the eastern flank of the salt dome of Broistedt-Rolfsbuettel. In Meerdorf, situated at the western edge of the Gifhorn trough, good oil and gas shows were encountered, the economic importance of which must yet be evaluated by further drilling.

Weser-Ems district held second place with regard to the increase of

Continued on Page 312

Surveys "Down Under" Added To Aero Operations In Europe, Africa, Near and Far East, South America

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SS. M. E. LOMBARDI anchors beyond coral shelf at Wake Island—mid-point in its monthly 8000-mile round trip out of San Francisco to deliver fuel and lubricants to the Pacific Ocean airlines stop. At right is part of Wilkes Island.

Oil Fuels the Facilities Of a Mid-Pacific Airport

Midpac Operations on Wake Island, neutralized in December, 1941, by invading Japanese, is back—stronger than ever—to forge a link between the East and West.

ABOUT ONCE A MONTH, the tanker M. E. Lombardi, down to her marks, heads out through San Francisco's Golden Gate, bound for a tiny coral atoll more than 4000 miles out in the Pacific Ocean—historic Wake Island. Her mission: deliver fuel and lubricants to keep trans-Pacific passenger and freight airlines moving.

This is a part of Midpac Operations, participated in by Standard Oil Company of California and three other oil companies. Standard is operator for all four at Wake.

Midpac was organized in August, 1947, to serve commercial airlines flying the Pacific with passengers and mail for the Philippines, the Orient and beyond. During the Korean airlift, however, the operation took on added significance. Air traffic increased rapidly. Most of it was of high priority. It had to be kept moving.

During the Korean fighting, air traffic zoomed. At times, as many as 70 planes arrived and departed within 24 hours. The seven-man crew was increased. With the volume of traffic being sustained at a high peak, a crew of 23 men was built up for 24-hour service. Recently, traffic averaged between 25 and 30 planes daily.

A plane may require from 2200 to 3000 gallons of gasoline. Or, in some cases, as much as 5000 gallons. Delivery of 20 gallons of lubricating oil to one plane is not unusual.

In addition to serving the planes, Midpac also serves the remainder of the island—the facilities that make air operations possible. Fuel is delivered to the power plant to run its big engines. The battery of diesel engines in the sea water distillation plant are supplied with fuel.

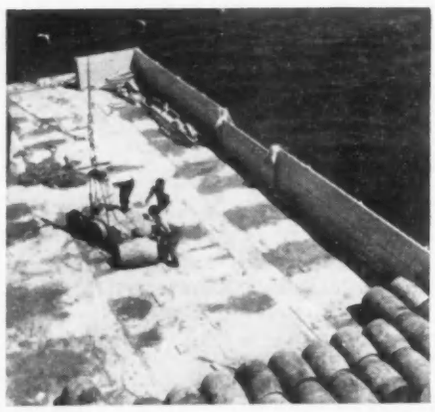
Midpac Operations stands as one more monument to modern progress and global intercourse which depends on oil—whether on a lonely Pacific atoll or on a Kansas tank farm.

ACKNOWLEDGMENT
Information from Standard Oil Company of California Bulletin

—The End

Standard Oil Company of California Bulletin photos

ON A WING THAT SPANS the Pacific Ocean, a Midpac Operations man delivers fuel for another long flight.



MOTOR OILS, thinners and other packaged products are loaded on barge for trip ashore.

HEAVY HOSE, buoyed by empty oil drums, stretches from ship to shore, carrying gasoline for trans-oceanic flights.

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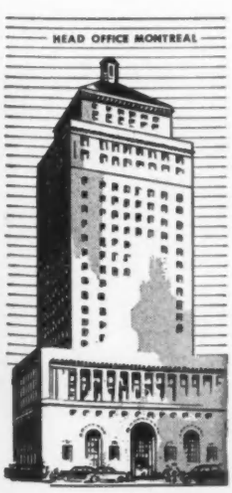

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Originally drilled to 13,700 feet, this well—Omati 1 in Papua—was sidetracked by Australasian Petroleum Company because of difficulties in the hole. The well was reportedly drilling past 12,000 feet.

Australasian Turns to U. S. Equipment for Papuan Tests

Drilling in dense New Guinea jungles is no simple matter . . . even with modern equipment.

In a jungle area in Papua, on the island of New Guinea, Australasian Petroleum Company is using U. S. equipment to drill a test well which may reach below 15,000 feet.

A 450-horsepower rig, designed for 4000-7000-foot drilling range, using one 1⅛-inch wire line with a 20-inch-by-34-inch hoisting drum was used for the first 7500 feet. To reach the greater depths required, the rig was replaced by a 1300-horsepower rig designed to drill to the 10,000-16,000-foot range and using a 1⅜-inch wire line on a 30-inch-by-56¼-inch hoisting drum.

After importing much of its machinery and equipment from the U. S. to Port Moresby, Australasian Petroleum transports it 270 miles across the Gulf of Papua and upriver, using a small, shallow draft freighter. The test operations are up the Omati river, where docking facilities have been set up.

The area is a hilly one, covered with dense forest. Many trees had to be cleared away to provide a camp site. Warehouses and shops are built on graded level spots, but following the custom of the country the houses and the club are built on posts along the hillsides.

The first well in the area, Omati 1, was originally drilled to 13,700 feet, but because of some difficulties the hole was sidetracked and was being drilled at about 12,000 feet. This operation is with a 1000-horsepower rig designed for drilling in the 8500-12,000-foot depth range, powered by two 8-cyclinder diesel engines rated at 375 continuous brake horsepower when operating at 900 rpm. The engines have hydraulic couplings. Two 7¼-inch-by-15-inch mud pumps with fluid end ratings of 2500 psi are being used and each has 250 rated output horsepower at 60 strokes per minute.

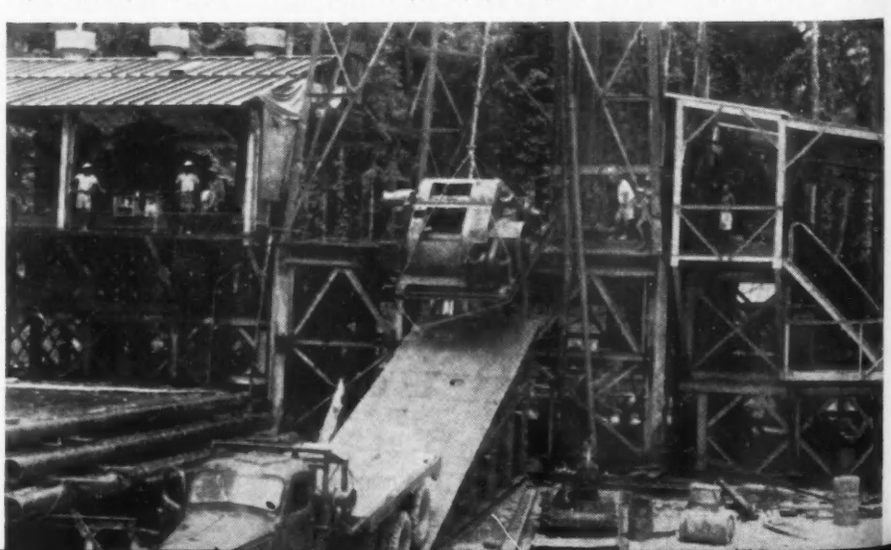
Omati 2 is about four miles farther into the hilly jungle. The original 12-inch hole drilled was opened to 17½ inches down to 5600 feet, and 5500 feet of 13⅜-inch casing was set.

Power for the initial rig was provided by two 6-cylinder, 4-cycle diesel engines, each rated at 280 horsepower at 900 rpm, with hydraulic couplings. Independent mud pump equipment consisted of two 7¾-inch by 18-inch mud pumps with fluid end rating of 3000 psi, powered by 6-cylinder diesel engines with hydraulic couplings, and a 7¼-inch by 15-inch mud pump powered by a 6-cylinder diesel engine with hydraulic coupling. This same "pump house" equipment now is being used with the larger rig, which is powered by a two-section drive group using 8-cylinder, diesel engines with hydraulic couplings.

The 4000-7000 foot range drilling rig was used to lift the sections of the 10,000-16,000 foot range rig into place. The dead end of the drilling line was then spooled onto the drum of the larger rig and the blocks were used to remove the smaller rig's drawworks and two-section drive.

—The End

Drawworks of the 4000-7000-foot drilling range rig, which drilled the first 7500 feet of Omati 2, in Papua on the island of New Guinea, is lowered by lines supported by larger rig, capable of drilling to 10,000-16,000 feet, which replaced it. Earlier, Australasian Petroleum had used the smaller rig to lift sections of the larger rig into place. This well, 270 miles across the Gulf of Papua and up the river from Port Moresby, may possibly be drilled to 15,000 feet or more.



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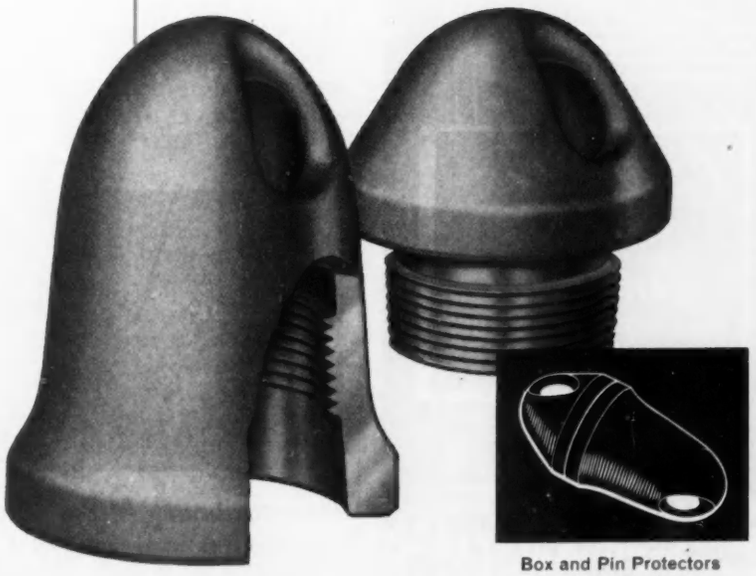

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J. M. PATTINSON, C.B.E.

E. H. Tanner, President of Triad Oil Co. Ltd. announces the appointment to the Triad Board of Directors of J. M. Pattinson, C.B.E., a Managing Director of The British Petroleum Company Limited, London. Mr. Pattinson will represent British Petroleum on the Triad Board. (Adv.)

What's Happening

AMONG WORLD OIL MEN

Japanese Oil Men Visit WORLD OIL Offices

Four representatives of the Teikoku Oil Company of Japan in the U. S. on an extended tour of oil field installations, recently visited WORLD OIL headquarters at Houston, Texas. Shown with Warren L. Baker, editorial director of WORLD OIL, center, are S. Nagano, Oil Well Supply division, U. S. Steel Corporation, New York; Tadamasa Hoizumi; Mitsuzo Kinno, assistant manager of Yamagata District; Ryozo Niijima, technical advisor; Saburo Todo, mechanical superintendent of Teikoku Oil Company; and H. Yumura, The National Supply Company, New York. Nagano and Yumura escorted the four visitors on their tour in the U. S.

RAYMOND F. KELLER, general manager of Canadian operations, has been appointed a vice president of General Geophyical Company.

Raymond F. Keller

Keller was educated in the public schools of Colorado, and was awarded the degree of geological engineer by the Colorado School of Mines in 1941. He was employed by General Geophysical Company as second computer immediately after graduation from college, and was promoted to party chief in January, 1944. Keller's promotion to supervisor came in August, 1949, when he took charge of General's Canadian department.

His residence will remain in Edmonton, Alberta, where General maintains its Canadian headquarters office.

•

FORREST E. WIMBISH, who has been Magnolia Petroleum Company's district geologist in charge of the Midland, Texas, district, has been transferred to Socony-Mobil Oil Company, Inc., and has moved to Lisbon, Portugal, where he will be in charge of that company's exploration operations.

International Visitors Attend Meeting

International guests who attended the May meeting of the Houston Nomads included (front row, left to right) John J. Foster, R. J. S. Germain Company, Houston; W. T. Short, Brazos Oil & Gas Company, Houston; J. G. Youngblood, Texas Petroleum Company, Bogota, Columbia; J. A. Wirtensohn, Asiatic Petroleum Company, Houston; and E. F. Hulsman, Shell of Colombia, Bogota. Back row, left to right, are M. L. Delano, export representative, New York; Del Redding, Phillips Petroleum Company, Houston; R. L. Foster, Socony Mobil, New York; and R. E. (Bob) Smith, oil operator, Houston. Smith was guest speaker at the meeting.

G. R. Schoonmaker

C. W. Donnelly

G. R. SCHOONMAKER, The Ohio Oil Company's district manager at Calgary, Alberta, has been appointed assistant manager of the Foreign division, headquartered in Findlay.

Stanley B. White

Succeeding Schoonmaker in the Canadian post is C. W. DONNELLY, division geologist at Terre Haute, Ind. STANLEY B. WHITE, district geologist at Casper, Wyo., will replace Donnelly.

G. A. KELLENBERG has been elected comptroller of the Arabian American Oil Company, and will make his headquarters at Dhahran, Saudi Arabia. Former assistant comptroller, he has been with Aramco and affiliated companies for 25 years.

G. A. Kellenberg

N. L. FALCON has been appointed chief geologist of The British Petroleum Company, a position which he takes over from P. T. COX, who, from 1953, has held the dual post of exploration manager and chief geologist. Cox will continue as exploration manager. Falcon joined The British Petroleum Company in 1927, and became manager of the company's Geological division in 1953.

N. L. Falcon

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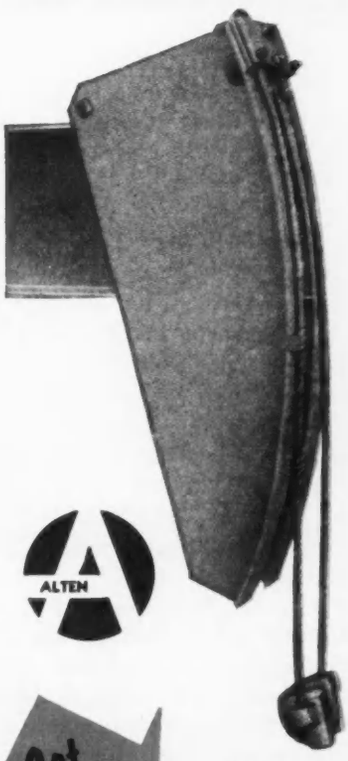

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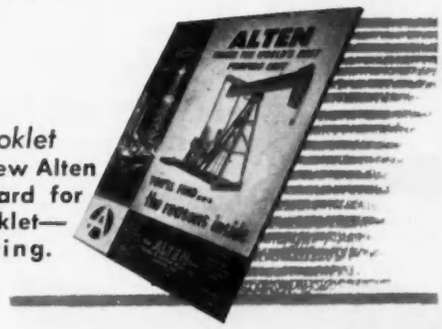

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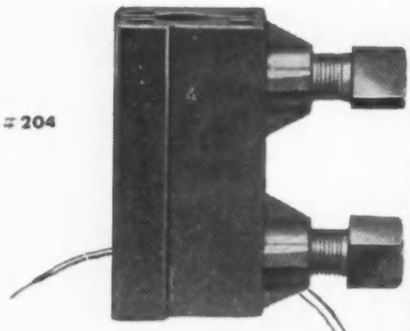

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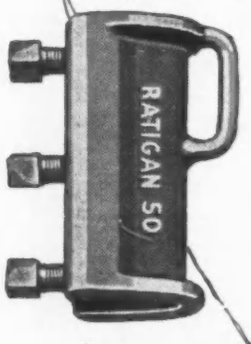

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Germany's Goal

Continued from Page 304

estimated reserves. As a result of some new discoveries made by Wintershall AG. south of Bremen and due to some revisions and extensions of older fields, the reserves figure of this area was hiked by 28 million barrels. In 1954 two new fields in the Weser-Ems district were listed, i.e., Bockstedt and Dueste-Wietingsmoor, both producing from the Cretaceous (Valendis), with the latter representing a typical stratigraphic trap. Both fields together produced 60,000 barrels of crude in 1954.

In Emsland, Holstein-Hamburg and the Upper Rhine valley oil areas the increase of reserves resulting from new discoveries and by extending productive zones in known fields is almost balanced by current output. In Holstein the 1954 drilling campaign resulted in the discovery of Bramstedt field which, in the Ploen and Boostedt, is situated on the western border of the deep Jurassic trough around Hamburg. The oil-bearing Dogger in the Bramstedt field, which is also bound to a structure of the stratigraphic trap type, delivers light crude of a specific gravity of 0.851 to 0.855. The initial output produced last year was 54,000 barrels.

After long years of wildcatting in the southeastern part of the Hamburg basin, Gewerkschaft Elwerath and Preussag found small production from the Posidonia shale in Hohenhorn 18 from a depth of about 8000 feet. Since the end of 1954, the well has pumped several hundred barrels a month.

Farther south, the same formation was found to be oil impregnated at the deep northern flank of the Meckelfeld salt dome from the top of which production on a small scale has been carried on since 1938. Lastly, Gewerkschaft Elwerath was successful in finding some oil in the Upper Rhine Valley graben at Wattenheim in the neighborhood of Stockstadt field.

Natural gas production of West Germany, too, rose considerably last year. Total output of the gas fields was 3000 Mmcf in 1954 as compared with 2000 Mmcf in 1953. Besides, 2200 Mmcf of gas were recovered as a by-product from the oil fields (1700 Mmcf in 1953). It is indicated that the country is in the early phase of a development making natural gas an important factor in energy supply. Even today, gas is a valuable contribution to the production of chemicals.

The two gas fields of Rehden, south of Bremen, and Pfungstadt, near Darmstadt, were put into regular production during 1954. Rehden has a relatively high potential and will probably push up the German gas output in the future. Under a contract between Wintershall AG. and the Steel Works of Georgsmarienhuette, near Osnabrueck, the gas output is conveyed to this plant. This field yielded 155 Mmcf of natural gas in December, 1954, and will, according to the forecast, ultimately have a daily output of 18 Mmcf.

In the Upper Rhine area, Stockstadt and Eich gas fields started transporting about 4.5 Mmcf of natural gas a day to the Badische Anilin- & Soda-Fabrik AG. (former IG-Farben), where the gas is used for production of synthetic ammonia.

The exploration successes of 1954 and previous years would not have resulted, had oil producing companies not carried out intensive drilling activities which in 1954 reached a total footage of 2.16 million feet, almost 1 million feet of which was accounted for by wildcats and extension wells. Protected by import duties, the price of German crude is relatively high. This fact makes it economic for operating companies to follow up so many exploration projects and to drill a footage which, compared to the international standard, is extraordinarily high in relation to the production effect. For 1955 the drilling program provides for 2.6 million feet.

On the other hand, considerable efforts are being made by the oil producing companies operating in Germany to lower drilling and production costs. This is all the more important as expensive secondary recovery projects must be carried through to stop normal decline in production from older fields, as higher costs arise by raised wages and prices for technical equipment, and as the average depth of wells increases.

After World War II the drilling industry tried to cut drilling time by using jet bits and equipping rigs with slush pumps and motors of higher capacity. Also, time required for the moving of derricks was shortened, partly by the introduction of modern cantilever rigs. —**The End**

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Austria: The 1953 crude production level of Soviet Mineral Oil Administration in Lower Austria province fields centered around Matzen, Aderklaa and Zistersdorf was about 300,000 barrels less than 1953 output of 22 million barrels.

British Guiana: McBride Oil and Gas Corporation, San Antonio, Texas, has been granted a license by the British Guiana government to conduct offshore oil exploration in a 4000-square-mile area of the Continental Shelf.

Canada: It was expected that additional Alberta crude would begin flowing into Washington State possibly in June as initial line fill for the 36½-mile Washington spur line to the Shell Oil Company refinery under construction at Anacortes, Wash., was to be nominated for this month . . . Mid-year production from Alberta is expected to reach about 300,000 barrels daily . . . Work was scheduled to start shortly on an extension of Saskatchewan Power Corporation's natural gas line serving Saskatoon to Prince Albert . . . With completion of 222 wells in March, Western Canada's total first quarter completions included 627 wells—445 oil wells, 33 gas wells and 149 dry holes.

Cuba: Twenty-one rigs were in operation at the close of April—15 cable tool rigs and 6 rotaries.

Czechoslovakia: Prague has reported the government's production plan for the oil industry was fulfilled during 1954. No details were released.

Germany: Oil has been discovered at 4244-4500 feet in Schwabmuenchen 1, Bavarian wildcat 15 miles southwest of Augsburg, which was drilled by Gewerkschaft Brigitta for Elwerath-Wintershall-Brigitta . . . Total drilling footage for 1955 is expected to reach 2.6 million feet . . . Wildcat Steinkirchen 1 of Deutsche Vacuum Oel AG.-Bayerische Mineral-Industrie AG., drilled between the new Isen oil field and Ampfing gas field east of Munich, has encountered natural gas at 5470-5480 feet . . . The 14-inch, 5.6 mile, 60,000-barrel-daily pipe line from Esso AG tank farm in Neuer Petroleumhafen to the Harburg refinery is now in use . . . Ostenwalde 5, drilled by joint interest C. Deilmann-Gewerkschaft Elwerath about 1000 feet northeast of Ostenwalde 3 producer, has found production of 19-25 barrels daily at 4950-4986 feet.

Israel: Pan Israel Oil Company has spudded in a test at Mahtesh Hagadol, about five miles from Kfar Yeroham, where British interests conducted tests in 1945 . . . Israel-American Oil Corporation's test at Rahme 1, near Sde Boker, is being abandoned at 9120 feet—the third abandonment in the Negev desert. Previous abandonments were at Mazal 1, near Sdom, and at Be'eri, both Lapidot Oil Company tests.

Jamaica: Drilling was under way on the Base Metals Ltd. test at Negril Spot, six miles east of Negril in the western part of the island.

Mexico: Petroleos Mexicanos, government oil monopoly, has discovered two new fields—one, known as Tres Higueras and located in Soledad Doblade municipality, Veracruz state, has yielded light crude at 1650 feet; the second, a gas field near Reynosa, Tamaulipas, has yielded natural gas at 4310 feet . . . Drilling has begun in Ostuacion area in the southern state of Chiapas, where Pemex has launched a heavy investment program to investigate encouraging studies . . . Pemex has asked government permission to drill in Ozuluama, Veracruz state, and in municipalities of General Pedro Antonio de los Santos and Coxcatlan, in San Luis Potosi State.

New Zealand: Shell Company of New Zealand and Todd Brothers of Wellington will launch a joint $2.8

million oil exploration venture in the Taranaki district.

Pakistan: A specially-equipped airplane has arrived in Karachi to conduct aeromagnetometer surveys in the Indus Basin for Standard Vacuum Oil Company . . . Pakistan Petroleum Limited's test well near Sylhet has reached 4000 feet . . . Pakistan Petroleum Limited's test well at Haripur, five miles from Sylhet, was drilling ahead at 4000 feet . . . PPL also has begun drilling a well 40 miles from Sylhet, East Pakistan, which is scheduled to be drilled to 13,000-15,000 feet . . . PPL was to begin a gravity survey in Comilla district . . . The British Petroleum Company, Shell Oil Company and four major U. S. oil companies have applied for oil exploration concessions . . . PPL has reported a significant gas show in its Uch test well at 4000 feet. The well, in Bugti-Marri territory of Baluchistan, was spudded in Feb. 15, and had been drilled to 4218 feet with a 10,000-foot objective.

Portugal: Socony-Vacuum Oil Company, Inc., will direct Portugal oil exploration as contractor with a participating interest in the benefits of a Companhia Dos Petroleos de Portugal concession.

Rumania: The oil industry claims to have exceeded 1953 production by 43.9 percent in 1954.

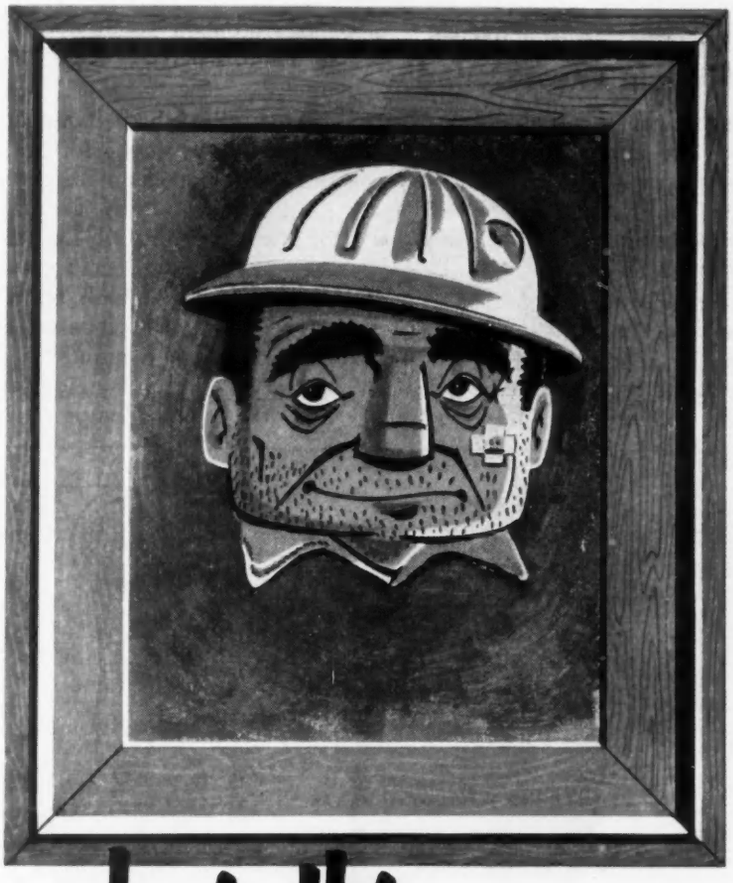
Russia: This year's exports of oil products (including Rumanian) to the West is expected to exceed 42 million barrels. In 1953 the level reached 31.5 million barrels.

Saudi Arabia: Crude production during March amounted to a daily average of 1,017,352 barrels.

Sicily: The firm Augusta-Ricerche Petrolifere Societa per Azioni, organized by Raffinerie Siciliane Olii Minerali (RASIOM) and Standard Oil Company (New Jersey), was scheduled to begin drilling in the district between Catania and Augusta.

Venezuela: Perforacioned Delta C. A. and Perforaciones Guarico C. A., subsidiaries of Delta Drilling Company, have acquired four drilling rigs from Compania Anonima Maracaibo Towing Company of Maracaibo, as well as surplus drilling equipment of Richmond Exploration Company, for expanded operations.

Yugoslavia: A 30-mile 6- and 8-inch pipe line will be built to connect Moslavina oil fields with the newly-constructed Sisak refinery on the shore of Sava river.



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170 Geophysical Parties At Work in West Canada

Geophysical operations in Western Canada are increasing, and currently 170 geophysical parties are at work—a record for 1955 and more than have been operating at any one time for the past 12 months.

Included in the operations are 157 seismograph and 13 gravity meter parties. In February, 162 geophysical parties were reported in the field, including 150 seismic and 12 gravity meter crews. That number amounted to about 5 percent below the current total.

More than three dozen companies or groups are paying for this exploration, with more than 50 percent of the parties employed by six major companies: Imperial Oil, Ltd., 20 crews; Texaco Exploration Company, 18 crews; Canadian Gulf Oil Company and Shell Oil Company, 16 crews each; Socony-Vacuum Oil Company of Canada, Ltd., 11 crews; and Stanolind Oil & Gas Company, 10 crews.

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Pemex Says 2 New Oil Fields Discovered

Discovery of two new fields during January was announced by Petroleos Mexicanos, government-owned oil industry. The new finds are "Acuatempax," located in the municipality of Tihuatlán, Veracruz; and "Ignacio Allende," in the area of Tecolutla, Veracruz.

High pressure had Acuatempa 1 out of control for 24 hours and officials anticipate production equal to or greater than of Ezequiel Ordoñez.

The Ignacio Allende strike resembles in production prospects and the high quality of its light crude the recently opened up Miguel Hidalgo field, also in Tecolutla.

Russia Unhappy with Baku Field Supervision

Russia is continuing to express dissatisfaction over operations of the Azerbaijan Republic Ministry of the Oil Industry, which supervises the Baku fiields.

The official Soviet government newspaper Izvestia concedes that "dozens of unnecessary trusts, administrations and offices have been abolished by the ministry" since Moscow started its crackdown last year. It says that "staffs have been reduced by 25 percent, and the makeup of oil-extraction, prospecting and construction trusts has been altered."

On the other hand, Izvestia declared, "the methods and work of the ministry itself remain virtually unchanged. The main attention and efforts of skilled cadres are still concentrated not on personal direction of the oil fields, plants and prospecting activities but on the compilation of orders, certificates, and reports on meetings and conferences."

Independents Agree On Iranian Participation

The 12 independent oil companies which are seeking association in the Iranian consortium reportedly have agreed to an equal division of the total 5 percent share in the arrangement open to them.

However, it is also reported that some of the independent companies who applied for participation may de-

cide to turn their shares over to others under possible crude sales commitments.

American Independent Oil Company brought to 12 the number of independents cleared for possible participation in the consortium. Aminol's clearance by Iran and U. S. followed its appeal from conditions for qualification made earlier by the qualifying agency, Price Waterhouse and Company, a New York accounting firm.

Photo-Geophysical Work Is Under Way in Yemen

Will Yemen join the gradually lengthening list of oil-producing countries? The answer lies partially in the work now under way by the gravimetric crew of Prakla, a German firm, which is operating in Yemen.

Under study now by the crew are air photographs which have been taken over a 1500-square-mile area of Yemen. The work leading to the photographing began in the Tihama coastal plain of this Arabian country about a year and a half ago. It was undertaken by Plan and Karte, Muenster, Germany, and Prakla.

After the conclusion of the oil concession contract between C. Deilmann of Germany and the Yemen government in the summer of 1953, the first objective was to obtain reliable maps to facilitate the work of the geophysicists and geologists. But only one general map on a scale of 1 to 1 million had then been available, and it was not adequate for detailed studies.

Therefore, it was decided to turn to photographic surveying by airplane to compile maps on a scale of 1 to 25,000. And by the end of 1953 and the beginning of 1954, photographers began taking photographs on a scale of 1 to 40,000 from a height of 15,000 feet.

The work was first concentrated on a 15,000-square-mile area near Salif selected for the exploration for oil and located about 30 miles north of Hodeida port. The photographs are being used as the basis for the compilation of the 1 to 25,000 sheets, and will offer a simultaneous opportunity of a photo-geological interpretation by means of reflecting and magnifying stereoscopes.

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Russia Claims 1954 Crude Production Up

Russia claims to have boosted oil production to record peaks during 1954.

A report issued by the USSR Council of Ministers' Central Statistical Administration said the Ministry of the Oil Industry exceeded its over-all goals by 3 percent last year. Output was above the government's plan for crude oil, natural gas, gasoline, kerosine, diesel fuels and fuel oil.

These specific gains were announced for 1954 as compared with 1953: crude oil 12 percent, gasoline 9 percent, kerosine 5 percent, diesel fuel 44 percent and natural gas 9 percent. Gains previously announced for 1953 as compared with 1952 were: crude oil 12 percent, gasoline 11 percent and kerosine 23 percent. No mention of increases in diesel fuel and natural gas output for 1953 was made.

The statistical administration gave no concrete figures on 1954 oil production. However, based on the announced output of 377,832,000 barrels in 1953, Soviet production in 1954 was about 422,881,200 barrels.

Speed of operational drilling increased 5 percent and the speed of exploratory drilling 6 percent in 1954 as compared with 1953, it is claimed. Proportion of light petroleum products obtained from crude at refineries is said to have increased again.

On the other hand, the report charged that the increase in exploratory drilling speed was below goals set for last year, and the industry as a whole permitted considerable idleness of drilling equipment.

New Venezuela Bids Still Under Consideration

Dr. Edmundo Luongo Cabello, Venezuelan minister of mines, said recently in Maracaibo that the bids for new petroleum concessions were still under study by the government. The minister said, in reply to a direct question concerning concessions, that the government continues to believe in arrangements with private capital and that many petitions for concessions have been received and are being studied.

He apologized for not answering the question more directly, but said he could not do so at this time. He

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did, however, say the government has been receiving more petitions recently than at any previous time.

Elaborating on his "indirect" answer, Dr. Luongo said Venezuela is interested in increasing its proven reserves which now amount to about 10 billion barrels, and that the best way to do this would be to allow new exploration to take place.

Asked about terms of possible new concessions, he said they would depend upon the circumstances. "The government," he said, "naturally wants to drive the best bargain possible," but, at the same time, it will not go to the extent of "wounding the creative power of private capital."

At another point, he added:

"You can be sure of one thing. Our oil and our other mineral deposits are not and will not be available to the enemies of democracy."

Difficulty in Assessing Sicily Oil Is Indicated

The extent to which Sicily's oil industry will progress during the next ten years cannot be determined now, indicates C. E. Woodbridge, director of Compagnia Idrocarburi della Sicilia d'Arcy (CISDA), a subsidiary of The British Oil Company, Limited.

Although results of oil exploration and drilling during the past 20 years have amounted to production of 21,655 barrels of crude from Ragusa Wells 1 and 2, he said that future results depend upon various factors, including domestic conditions. The latter are questionable in view of the demonstration against operation of foreign firms in Italy organized by Communist agitators and Christian Democrats when the first oil shipment left Ragusa by rail.

In addition, the mayor of Victoria reportedly has criticized d'Arcy for stopping drilling at 9842 feet. Woodbridge says the company was forced to stop drilling more on account of the low density (13 degrees) of the crude from Victoria wells.

Even the Ragusa crude is not considered satisfactory, it is reported, since its density varies between 18 and 19.8 gravity and since wells must be pumped.

Woodbridge believes that in Sicily 23 to 26 pumping wells will be required to obtain a daily output equal to production of a single Middle East flowing well.

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What's Happening

AMONG MEN IN THE INDUSTRY

M. C. Brunner

E. N. Van Duzee

M. C. Brunner, production manager of **Shell Oil Company's** Midland area, has been named to a senior administrative and engineering position abroad. Replacing Brunner as Midland production manager will be **E. N. Van Duzee,** presently production manager of Shell's New Orleans area. Brunner joined Shell in Los Angeles in 1926. In 1947 he was made district superintendent at Hobbs and in the following year was named area production manager. Van Duzee joined Shell in 1926 at Dallas. In 1939 he was promoted to manager of the Oklahoma division and in 1947 was named Louisiana division manager. He was promoted to production manager at New Orleans in 1948. Van Duzee will be replaced at New Orleans by **J. W. Pittman,** presently on special assignment in New York. Pittman started with the company as a roustabout in 1934 at Kilgore, Texas. He became district superintendent at Lake Charles, La., in 1945. A year later he became manager of the Lake Charles production division and subsequently advanced to production superintendent of the New Orleans area. In Shell's Houston area, **W. S. Crake,** formerly chief mechanical engineer, has been advanced to area production superintendent. Replacing Crake is **J. R. McEntee,** who has been serving as chief development engineer on the staff of the technical services division. Crake, a veteran of 28 years with Shell, served 12 years as senior and chief mechanical engineer in Houston and two years as division production manager in Kilgore. He returned to Houston as chief mechanical engineer in 1953. McEntee joined Shell in 1936 in California, and was engaged in engineering work when he was transferred to Houston in 1951 as senior mechanical engineer.

•

Lt. Gen. Ernest O. Thompson, Commissioner, Railroad Commission of Texas, has been designated as a representative of the U. S. Government on the Committee of Honor for the Fourth World Petroleum Congress to be held in Rome this month. Other designees are Douglas McKay, Secretary of the Interior, and Clare Boothe Luce, American ambassador to Italy.

•

Robert I. Dickey was recently elected vice president, Exploration, and a director of **Texas Pacific Coal & Oil Company.** Dickey joined Texas Pacific's Exploration department in a management capacity on April 1. Previously, he had been vice president of Forest Oil Corporation, Midland, and with Stanolind Oil & Gas Company.

Donald P. Jones, comptroller, **Sun Oil Company,** has been elected a director of the Controllers Institute of America. Active in the organization since 1947, Jones is president of its Philadelphia Control.

•

Russell Cobb Jr., Inc., oil producing firm, has announced four executive appointments. **William M. Martin** has been named executive vice president; **Plummer Tilley,** manager of the Accounting department; **H. S. McClintock, Jr.,** manager of the Geological department; and **Lawrence E. Wilsey,** Production department manager. Prior to joining the firm, Martin was an independent lease broker and was employed in the land department of British American Oil Producing Company. Tilley formerly was associated with L. B. Jackson, British American Oil Producing Company and Phillips Petroleum Company. McClintock was with Phillips Petroleum before joining the firm, working in Amarillo and Ardmore, Okla. Wilsey formerly was employed by Stanolind Oil and Gas Company.

•

A. M. Shook

A. M. Shook has been made division petroleum engineer of South Texas division, Producing department, **The Texas Company.** He succeeds **W. F. Herbert,** who was transferred to foreign operations. Shook first worked for Texaco in 1937 as a roustabout. In 1946 he went to the Premont area as petroleum engineer, and has been acting division petroleum engineer since November, 1954.

•

William F. Styler, Jr., has been elected vice president and treasurer, **Deep Rock Oil Corporation.** He has been associated with Deep Rock since 1949 and has served as controller for the past year. In his new capacity he will be in charge of all the company's financial affairs. **Orville O. Kerr,** with Deep Rock since 1917, has been named company secretary.

•

J. W. Caldwell has been named manager of production and exploration for the **Batex Oil Company,** Dallas. Prior to joining Batex, Caldwell was district production superintendent for the Great Lakes Carbon Corporation in the tri-state Illinois basin area, and has more than 20 years' experience in the oil development field. Caldwell will head the Batex field supervisory force, assisted by **Ed Sisson** of Rio Grande City, Texas; **Herman Endicott** of Yale, Okla., and **William Willman** of Mt. Vernon, Ind.

•

Oceanic Oil Company recently announced the election of **R. W. Dye** to the position of vice president. Dye, an attorney, was with Standard Oil Company of California six years before joining Oceanic. Since 1952 has been in charge of Oceanic's Legal department.

T. H. Philpott

E. C. Brimberry

Arthur H. Trowbridge

Olin Oil & Gas Corporation and **Olin Gas Transmission Corporation,** have announced the following promotions within the two organizations: **T. H. Philpott,** formerly Shreveport area exploration manager, has been promoted to exploration manager of the companies and transferred to New Orleans. Philpott has been associated with the Olin organizations since 1953. **Earl C. Brimberry** has been promoted to manager of the Production department. He was formerly associated with Interstate Natural Gas Company, Inc., having first gone with that company in 1927. Interstate was merged into Olin Gas Transmission Corporation in May, 1954. The new acting area exploration manager of the Shreveport area is **Arthur H. Trowbridge,** who formerly served the companies as area geologist, Shreveport area. Trowbridge has been with Olin since October, 1953. He was previously employed by the Gulf Refining Company in its Shreveport district office.

•

Lion Oil Company has elected five vice presidents. **Jeff Davis,** who has been secretary since 1931, was named vice president and general counsel; **E. W. Atkinson,** treasurer since 1943, was elected vice president and treasurer; **J. B. Rogerson,** formerly manager of manufacturing, was made vice president in charge of manufacturing; **R. C. Tallman,** research director, was named vice president in charge of research; and **J. H. Sheehan,** who has been manager of petroleum sales, was made a vice president. Other new officers elected were: **B. L. Allen,** secretary; **R. P. Latimer,** assistant secretary; and **W. M. Rodman,** comptroller and assistant treasurer.

•

Stanley Harlow has been named vice president in charge of drilling and production for the **Harlow Petroleum Company** of Tulsa, with offices in Cushing, Okla. He will supervise operations in Lincoln, Payne and Pawnee Counties.

•

S. R. Hollnesbee, geological scout for Calvert Drilling, Inc., has joined **National Associated Petroleum Company,** Tulsa, as geologist. He will be located at Mt. Vernon, Ill.

J. A. Neath

C. E. Reistle, Jr.

R. J. Schilthuis

Ray H. Horton

J. A. Neath, an employe of **Humble Oil & Refining Company** since 1919, has been elected chairman of Humble's board of directors. He succeeds **L. T. Barrow** who has retired. At the same meeting, board members named **C. E. Reistle, Jr.** a vice president. **David Frame,** Humble vice president, will retire in August. Neath was made an Humble Pipe Line division superintendent at Cisco when the Southern Pipe Line Company, with which he was associated, was taken over by the Humble system. He was made general superintendent of the Humble Pipe Line Company in 1924. He became a vice president in 1928, a director of Humble Oil in 1942 and a vice president in 1947. Reistle joined Humble in 1936 as assistant chief petroleum engineer. He was made chief petroleum engineer in 1940, manager of the production department in 1945 and was elected a director in 1948. New directors of Humble Oil elected by the board include **Herman P. Pressler, Jr.,** associate general counsel; **Ralph J. Schilthuis,** assistant manager of the Production department; and **Ray H. Horton,** employe relations manager.

•

C. B. Wentz has been promoted to assistant manager of **Continental Oil Company's** southern region. Manager of the company's headquarters coordinating and planning department since 1952, he will continue to make his headquarters at Houston. Wentz joined Conoco at Ponca City, Okla., in 1938. In 1950 he was made chief proration engineer in Houston. Succeeding Wentz is **J. W. Ferguson,** for the past two years assistant manager of Conoco's coordinating and planning department. He joined Conoco as senior analyst in 1952. He formerly was associated with The U. S. Bureau of Mines.

•

James W. O'Keefe has been named comptroller for **Texas Gas Exploration Corporation.** Former supervisor of special studies for Texas Gas of Owensboro, Ky., he has served as general accountant for the production subsidiary since December. O'Keefe joined the Texas Gas organization in June, 1948, as auditor and accountant and became supervisor of special studies in April, 1953.

Sun Oil Company has announced the appointment of **Henry C. England, Jr.** as coordinator of safety, Production department. His office will be at Sun's Southwest Production division headquarters in Dallas. England has been safety and personnel man for Sun in southwest Texas, with headquarters in Corpus Christi. He will be succeeded by **O. Trotter Adams,** former safety man in the Midland district. England joined Sun in 1939 at Brenham, Texas, and served as junior petroleum engineer at Odessa, Corpus Christi and Delhi, La., before being named safety and personnel man at Corpus Christi in 1947. Adams has been in the Industrial Relations department since shortly after joining Sun in 1946. He moved from the Dallas office to Midland in 1951.

Gulf Oil Corporation has announced that **C. B. Hussey** has been transferred to the Western Gulf Oil Company, and **H. S. Brigham,** transferred from the Western Gulf Oil Company to the Houston Production division as zone superintendent of production, Laurel zone. **W. E. Boyd** has been appointed Production division drilling engineer, and **M. R. Redick** has been appointed zone drilling engineer, Pierce Junction zone.

•

Dr. Louise Jordan has joined the **Oklahoma Geological Survey** staff at Norman, working on subsurface geology. Previously she taught at Mount Holyoke and in Turkey, and was geologist with Sun Oil Company, with Anzac Oil Company and in the Middle East.

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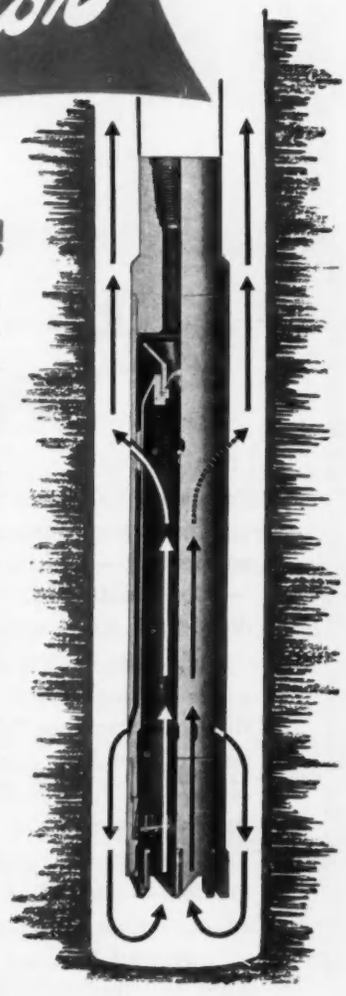

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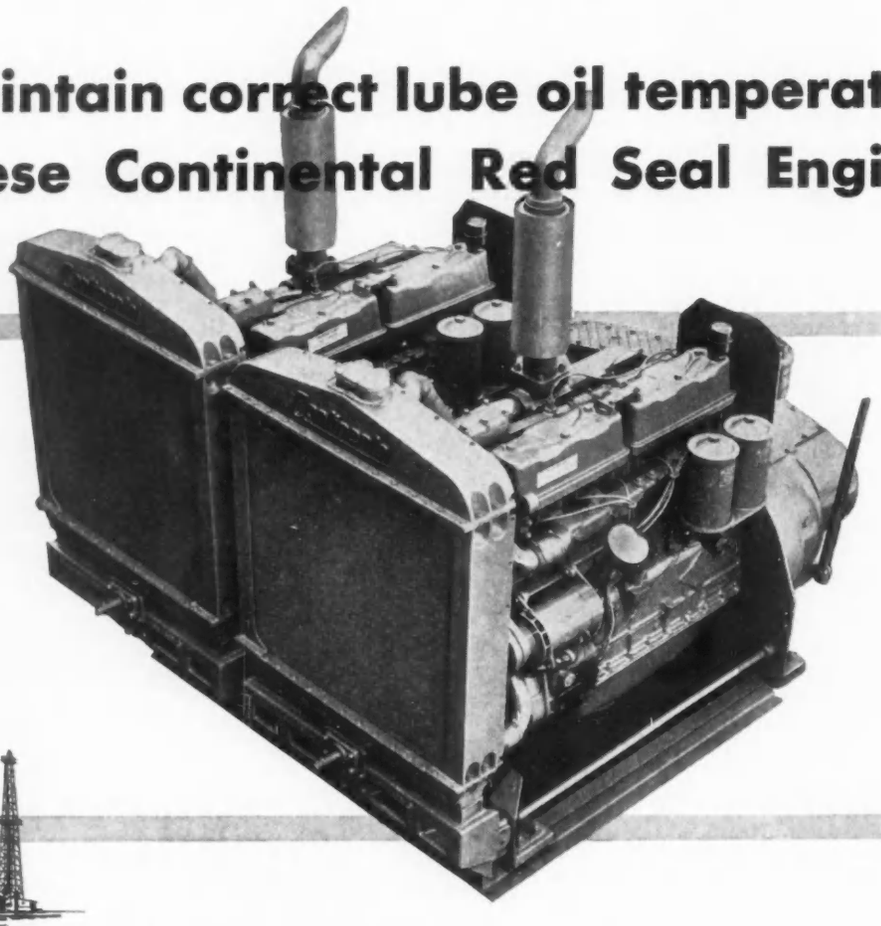

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George Y. McCoy has been elected president of the **International Oil Corporation.** A petroleum consultant in Dallas for the past seven years, he had previously been with the oil loan department of the Republic National Bank, following a tenure on the petroleum engineering faculty of the University of Texas. Earlier employment was with **Shell Oil** and Skelly Oil Companies. Other executive changes in International Oil Corporation include the elevation of **E. E. Fogelson** from president to chairman of the board of directors, and the election of **H. T. Baxter** as treasurer.

George Y. McCoy

•

Roosevelt Oil and Refining Corporation of Mt. Pleasant, Mich., has elected the following directors: **E. Allan Morrow, C. L. Maguire, T. J. Williams, Albert M. Stern, S. W. Judd, L. A. Woodward** and **David W. Smith.** Morrow was reelected president.

•

C. C. O'Boyle, geological engineer, has announced his affiliation with A. E. Brainerd and F. M. Van Tuyl, consultants in petroleum, economic and engineering geology. O'Boyle's office is in the Empire Building, Denver.

•

W. E. Richardson, Jr., has been made assistant geologist in the Tulsa Office of **W. C. McBride, Inc. K. W. Lewis** is chief geologist and exploration manager with offices in company headquarters in St. Louis.

•

Magnolia Petroleum Company has announced the following transfers and promotions: **Owen H. Blexrud** moved from district geologist at Wichita, Kansas, to Midland, Texas; **Asa D. McRae,** former district geologist at Mt. Vernon, Ill., transferred to Wichita as district geologist in charge of the Kansas district; **Harold J. Fitzgeorge** moved from the Abilene district to replace McRae at Mt. Vernon; and **Wayne H. Mack** transferred from Jackson, Miss., to Abilene. In the Producing division, **Kenneth R. Joynt** has been promoted from district superintendent of the Pegasus producing district to assistant division superintendent of the Oklahoma producing division headquartered at Oklahoma City; **Cletus H. Samples,** assistant superintendent of the Pegasus district, named to replace Joynt as superintendent; **John Henry Myers** advanced from production pumper to assistant production foreman in the Wewoka, Okla., producing district; **Joseph M. Huston** promoted from gang pusher to assistant production foreman in the Chase district; **Albert W. Shaw, Jr.** advanced from assistant foreman in the Pegasus district to production foreman in the Panhandle district headquartered at Pampa, Texas; **J. B. Merritt** promoted from gang pusher to assistant production foreman in the Pegasus district; and **E. L. Winterbauer** promoted from assistant foreman to production foreman in the Luling district. In the Petroleum Engineering department, **Fred S. Wright, Jr.,** engineer for the West Texas division, has been promoted to assistant general superintendent of Magnolia's part interest operations and moved to the general offices in Dallas; **H. K. Holland, Jr.,** Oklahoma division engineer, moved to the West Texas division succeeding Wright; **D. F. Pendley, Jr.,** promoted to division engineer to replace Holland; **William A. Daniel,** district engineer at Kermit, Texas, advanced to assistant division engineer at Oklahoma City; **V. M. Leonard,** district engineer at Duncan, moved to Kermit; **Charles L. Barney,** engineer in the Pegasus district, promoted to district engineer at Duncan; **W. L. Morris,** transferred from the department at Kermit to the Producing division as assistant production foreman; **Royal J. Christensen** advanced from junior engineer to engineer in the Electra district; **A. J. McCredie** promoted from junior engineer to engineer in the Oklahoma producing division; and **Archie M. Speir** advanced from petroleum engineer at Lake Charles, La., to senior engineer in Magnolia's Gulf Coast division at Houston.

T. L. Kunkel has been promoted to assistant division manager of the Geophysical division of **The Texas Company's** Producing department. He will remain in the Houston office where he has been assistant to division manager since 1953. Kunkel joined the company in 1934 as assistant recorder on a geophysical field party. Prior to his transfer to Houston, he was supervisor of geophysical operations in the West Texas division, with headquarters in Fort Worth.

•

Helen Wallace has retired from Standard Oil Company after 41 years of service in the oil business. For 16 years secretary to A. W. Peake, who recently resigned as president of Standard Oil, she will continue working for him in his San Francisco office.

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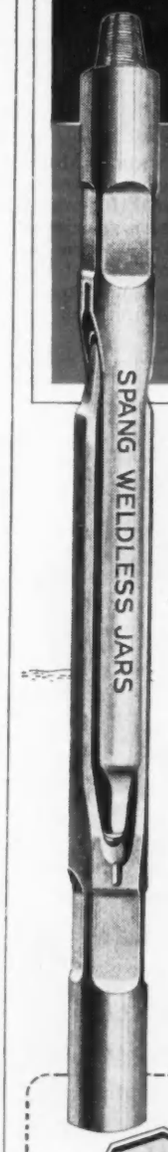

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Stanolind Employes Honored

Six employes of Stanolind Oil and Gas Company's North Texas-New Mexico division recently received 30-year service pins. Left to right, they are Elmer S. Pester, assistant division accountant, Fort Worth; Altus V. Maxwell, process foreman, Andrews, Texas; William P. Collis, head roustabout, Iraan, Texas; and Charles V. Campbell, resident pumper, Pampa, Texas. Not shown are John R. Evans, vice president and division manager, and William O. Grace, resident pumper at Panhandle, Texas.

Don O. Freeman is a new vice president of **Warren-Bradshaw Exploration Company.** With the company since 1949, he was assistant to the president before being promoted to manager of the Land-Geological department in November, 1954.

•

John F. Seal, vice president in charge of finance and a director of **Socony Mobil Oil Company, Inc.,** has been elected a board member of the National Industrial Conference Board. Seal has been associated with Socony Mobil since 1924 when he joined Vacuum Oil Company, one of the predecessor companies, as assistant treasurer. He was elected vice president in charge of finance in 1947.

Humble Oil & Refining Company has announced four principal changes in the organization of the company's Exploration department. **E. A. Wendlandt,** acting chief geologist, will become chief geologist of the department, and **H. G. Patrick** will become chief geophysicist of the Geophysics Exploration and Research division. **J. Ben Carsey,** former chief geologist, has been given the new position of exploration advisor. **D. P. Carlton,** former chief geophysicist, will become geophysics consultant, a new position set up to assist in organizing the new Geophysics division of the Exploration department. In other changes, **Dr. W. M. Rust, Jr.,** former chief of the Geophysics Research section, will become acting assistant chief geophysicist; **R. R. Thompson,** assistant chief of geophysics research, will become acting chief of the Geophysics Research section; **C. S. Fleischmann,** acting staff geophysicist, will become acting chief Seismic section; **J. L. Patton,** division geologist of the Eastern Exploration division, will become division geologist of the East Texas division; and **W. C. Blackburn** will assume temporary charge of the Tallahassee office after Patton's departure.

•

Hugh H. Beach, promoted to chief geologist, **The Texas Company's** Producing department, has been transferred from Calgary to Houston. He succeeds **G. M. Clement,** who recently was transferred to the Research division at Bellaire, Texas. After service with the Geological Survey of Canada, Beach joined McColl-Frontenac Oil Company as senior geologist in the Western division in 1943 and was made chief geologist in 1948. In 1951 he was transferred to Texaco Exploration Company as chief geologist. In 1952, he was promoted to assistant manager.

•

J. E. Roth, vice president and general manager of the Central division of **Tide Water Associated Oil Company,** has been elected to the board of directors of the American Petroleum Institute. He replaces **E. H. Salrin,** retired vice president of Tide Water.

•

George R. Wesley, staff geologist for **Skelley Oil Company** in Tulsa, has been promoted to division geologist for the Central division. Wesley will succeed **R. B. Rutledge** who was named division exploration manager.

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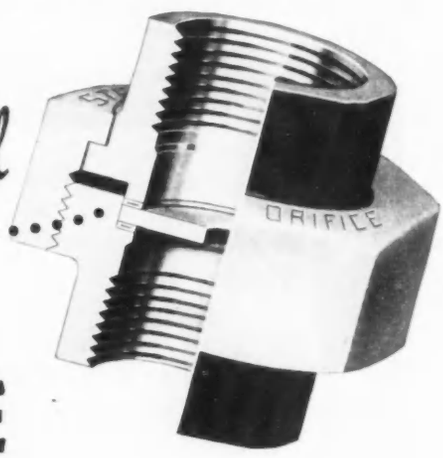

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J. F. Drake has retired as chairman of the executive committee of **Gulf Oil Corporation.** After serving 17 years as president, five years as chairman of the board and, during the past two years, as chairman of the executive committee, he will continue as a member of Gulf's board of directors and of the finance committee of the board. Drake first joined Gulf Oil in June, 1919, as assistant to the president. In 1923 he left to become president of the Standard Steel Car Company, which was merged with the Pullman Companies in 1930. He resigned as chairman of the board of Pullman, Inc. to return to Gulf as president in 1931. He was elected chairman in 1948 and, five years later, was elected chairman of Gulf's Executive Committee.

J. F. Drake

•

The Colorado Oil & Gas Company announces the appointment of **Richard I. Galland,** formerly with Olin-Mathiesen Chemical Company, as vice president and general counsel at Denver. **Stewart Carter,** formerly geologist for Continental Oil Company, has been named assistant to the chief geologist for Colorado; **Robert Angevine,** petroleum and reservoir engineer; and **Dudley F. Taylor,** controller. **James Whatley,** former chief geologist of the Union Sulphur & Oil Company, Houston, is new manager of the Texas-Louisiana division.

•

Jack A. Horner

Jack A. Horner, secretary of Shell Oil Company, has been appointed vice president in charge of the licensing division of **Shell Development Company.** An 18-year veteran with Shell, Horner has been secretary since April, 1953. He joined the firm as a member of the legal department. He was appointed assistant to the president in 1943. In 1949, he was named assistant secretary.

•

Carter Oil Company has named **R. E. Hammond,** production staff assistant of the Eastern division, division production manager. **Irvin Alexander** will replace him at Mattoon, Ill. Other appointments announced by Carter include: **H. W. McCormick,** district superintendent of the Vernal district, named district superintendent of the Carmi district; **B. M. Bradley,** assistant superintendent of the St. Elmo district, promoted to superintendent replacing McCormick; **J. L. Wible,** district engineer of the Jackson district, appointed assistant district superintendent of St. Elmo; **R. M. Pitcher,** senior engineer at Magnolia, Ark., named district engineer at Jackson; **J. L. Barthel,** acting district foreman at Purcell, Okla., named assistant district superintendent of the Purcell district and **R. D. Orr,** acting district engineer at Purcell, promoted to district engineer.

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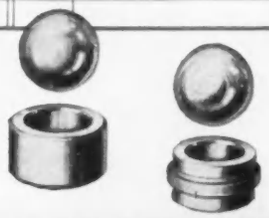
Q	*Can this condition be changed?*	A	Yes — both can be activated and given earning power.
Q	*How can they be activated?*	A	Draw some of the money from the safe deposit box — purchase and install a Pacific Oil Well Plunger Pump in the well — pump the oil to the surface. MONEY IN CIRCULATION — OIL IN CIRCULATION — BOTH WITH POWER TO EARN.
Q	*Why purchase and install Pacific Oil Well Plunger Pumps?*	A	Because only Pacific gives you the EXCLUSIVE MOLOY® LINERS with the strength, toughness, hardness, combined with greater resistance to temperature, corrosion and abrasion essential for long, economical life.



Plungers — Chrome-Plated then Pacilited for extra wear life.
Valves and Seats —To fit well conditions.
Extra Heavy Seats — Resist hammering of ball with less chance of distortion.

PACIFIC *Precision Built* PUMPS

DW-6

Pacific Pumps inc.
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HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Companies in the News

Drillers Receive Safety Awards

Fourteen drillers employed by A. W. Thompson, Inc., in the West Texas-New Mexico area were honored recently for having compiled one year or more of service without a lost-time accident. Five men received one-year certificates, seven received two-year certificates, one received a three-year award and one, a four-year award. Award-winners and officers of the company include, back row, left to right: D. E. Blue, E. D. Tannehill, B. M. Scheriger, D. W. McKissack, R. J. Kruse, Joe P. Smith, J. S. Franklin, C. G. Redwine, D. W. Harrison and C. Sibley. Front row, left to right Paul Shaffer, chief engineer; K. L. Beck, general superintendent; James McCullough; A. C. Bowers; A. W. Thompson, president of the company; Harry Woodward, assistant drilling superintendent; C. D. White and V. C. McCartney.

SOCONY-VACUUM OIL COMPANY, INC. shareholders have voted to change the company name to Socony Mobil Oil Company, Inc. to link the corporate name more closely with Mobil brand products sold. The Flying Red Horse emblem remains the same. The old name was adopted after the 1931 merger of the Standard Oil Company of New York (Socony) and the Vacuum Oil Company.

•

KERR-McGEE OIL INDUSTRIES, INC. Oklahoma City, has taken over the refining, marketing and pipe line activities of Deep Rock Oil Corporation, Tulsa. The transaction, approved by the boards of directors of both companies, became effective April 1. Deep Rock activities involved will be operated as a division of Kerr-McGee and no major personnel changes are expected. The division will be located in Deep Rock's present Tulsa quarters. The old Deep Rock organization will operate as an oil and gas producing, royalty, engineering and investment company under a new name to be announced. The company will continue to headquarter in Tulsa and will retain from the present organization the personnel needed to carry on and expand these activities.

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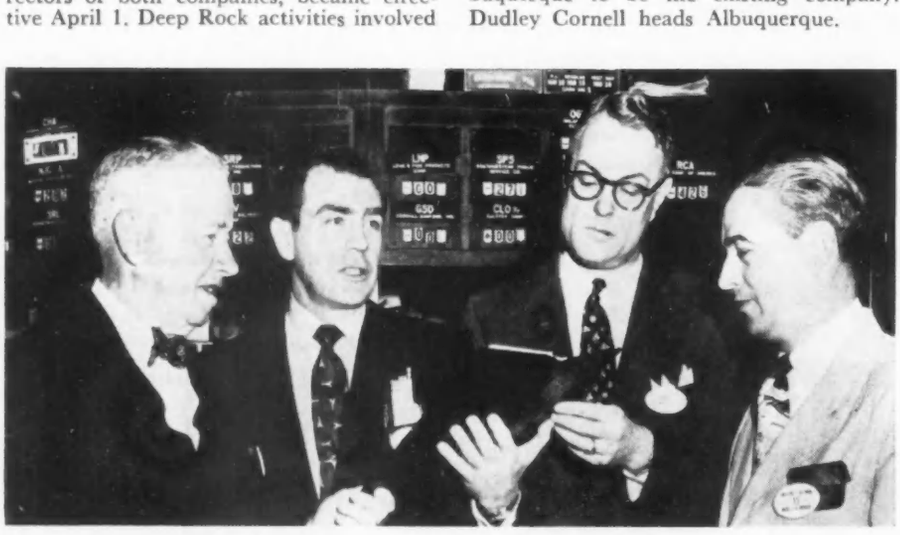
ALBUQUERQUE ASSOCIATED OIL COMPANY directors and the directors of Bolack Oil & Gas Company have approved merger of the two firms, with Albuquerque to be the existing company. Dudley Cornell heads Albuquerque.



Goes on Stock Exchange

C. T. Chenery, left, chairman of the board of Southern Production Company, Inc., is shown with G. Keith Funston, second from right, president of the New York Stock Exchange, on the morning that Southern Production's common stock was admitted to trading on the Exchange. Chenery bought the first 100 shares through the firm of Ingalls & Snyder. Second from left is William M. Meehan of M. J. Meehan & Company, specialists in Southern Production stock, and, at right, is Chester C. Veldran of Ingalls & Snyder. Southern Production is an oil and gas producing firm with headquarters in Fort Worth, Texas.

SUNRAY OIL CORPORATION and **MID-CONTINENT PETROLEUM CORPORATION** stockholders have voted the largest U. S. oil merger in 23 years. To be known as **SUNRAY MID-CONTINENT OIL COMPANY,** the new firm has assets exceeding $486 million. In size, the merger ranks second only to the Socony-Vacuum union in 1932. Chosen chairman of the board was **C. H. Wright**, former chairman of Sunray. Mid-Continent's president **R. W. McDowell** moves over as vice chairman. Sunray's president **W. C. Whaley** will hold the same post in the new organization. SDX will operate a wholly-owned subsidiary, D-X Sunray Oil Company, to handle oil refinery, pipe line and marketing facilities. D-X Sunray, in turn, takes over a pipe line subsidiary—Mid-Continent Pipe Line Company. The parent organization will handle administration, production and exploration. Joint production is estimated at 90,000 barrels of crude daily. Combined refining capacity is 100,000 barrels a day. Company pipe lines will handle between 20 and 25 percent of all crude oil produced in Oklahoma.

•

UNION SULPHUR AND OIL CORPORATION stockholders have voted to change the name of the company to Union Oil and Gas Corporation of Louisiana. The company's board of ten directors was reelected without change.

•

OHIO OIL COMPANY president J. C. Donnell II and W. C. Giggall, chairman of the board of Arapahoe (Colo.) County Commissioners recently turned the first spades of dirt at an 80-acre site at Littleton, Colo., 14 miles from downtown Denver, to signal the start of construction of Ohio Oil's new Research Center. Completion of the main building, which will provide 45,000 square feet of floor space, and the auxiliary building, housing garage, core-cutting shop and storage rooms, is scheduled for the first part of next year.

What's Happening

AMONG INDUSTRY ASSOCIATIONS

API Southwest District Names Fuson Chairman

T. J. Fuson, of Humble Oil & Refining Company, was elected chairman of the Southwest district of the Division of Production of the American Petroleum Institute at the annual spring meeting.

Also elected were 12 vice chairmen of sub-districts and two co-secretaries-treasurers on the final day of the three-day conference, which was attended by 1500 oil men from six states.

New vice chairmen and their regions are: A. D. Butler, Southwest Texas, Oil Field Motor Service; M. R. Hayes, West Texas, Phillips Petroleum Company; A. C. Dahl, Southwest Louisiana, Shell Oil Company; Ed Kuhn, North Texas, Bridwell Oil Company; W. W. Hammond, Balcones area, Ralph E. Fair Inc.; W. C. Best, Ark-La-Tex., Gulf Refining Company.

Also, Matt Gordy, South Louisiana, Stanolind Oil and Gas Company; J. G. Blevins, Jr., Southeast New Mexico, The Texas Company; Russell Birdwell, Rio Grande Valley, consulting engineer, McAllen, Texas; H. E. Treichler, Texas-Gulf Coast, Houston Oil Company; Ira Laird, East Texas, Gulf; and Royal Reiss, South Central Texas, Aluminum Company of America.

Co-secretaries-treasurers are Victor LeMay, Mid-Continent Supply Company, and J. M. Montgomery, Halliburton Oil Well Cementing Company.

Wyoming Geologists Plan Annual Field Conference

Daily trips into the Green River Basin are scheduled for the tenth annual field conference of the Wyoming Geological Association to be headquartered at Rock Springs, Wyo., July 29-31.

A caravan trip into the Manila area southwest of Rock Springs, trips through the Middle and South Baxter Basin gas fields and the Hiawatha gas field, and a half-day trip north of Rock Springs over the north plunge of the Rock Springs Uplift will be highlighted during the three-day conference.

Rocky Mountain AAPG Elects Thurman President

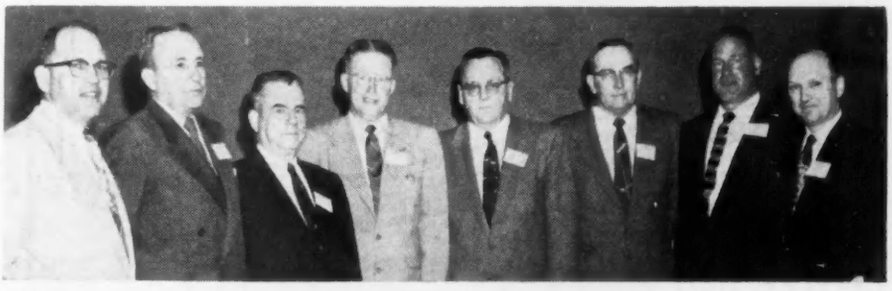
F. A. (Gus) Thurman, consulting geologist, will succeed J. R. Fanshawe as president of the American Association of Petroleum Geologists' Rocky Mountain section. His election was announced at the group's recent fifth annual meeting.

Other officers named were Fritz G. Nagel, Ohio Oil Company, vice president, and John E. Blixt, Halbert & Jennings, secretary-treasurer.

State representatives include D. B. Gould, professor of geology, Colorado College; Jack C. Cooper, Continental Oil Company, for New Mexico; Richard A. Howe, General Petroleum Company, for Utah; William C. McCabe, Stanolind Oil and Gas Company, for Wyoming, and K. A. Gorton, Mobil Producing Company, for Montana.

Illinois Oil & Gas Association Elects Officers

New officers of the Illinois Oil & Gas Association, elected recently at the tenth annual meeting of the group, include (sitting, left to right) Homer Rutherford, Rutherford & Company, third vice president; O. F. Beaty, Magnolia Petroleum Company, secretary; David R. Stewart, Moses & Stewart, president; Thomas N. Duncan, second vice president. Standing, left to right, are C. R. Collins, Collins Bros. Oil Company, treasurer; C. T. Smith, independent, general counsel; and Charles J. Pardee, executive secretary. Not pictured is E. J. Reading, Sun Oil Company, first vice president.



Officers of the API Division of Production, Rocky Mountain district include (left to right) George Goodin; H. B. Gernert, retiring district chairman for the Rocky Mountain district; A. W. Thompson, national vice president of the API Division of Production; R. W. Gemmer; Ray Wright; Roy Fuller; Richard Armstrong and R. E. McMillan. Not shown are R. M. Churchwell, chairman, and L. S. Fuller, vice chairman.

Churchwell Named Chairman Of API Mountain District

R. M. Churchwell, Ohio Oil Company, Casper, was elected new chairman of the Rocky Mountain district of the American Petroleum Institute's Division of Production, succeeding H. B. Gernert of Trigood Oil Company. Newly-elected vice chairmen for the district include: George Goodin, Petroleum Information, for Wyoming; Roy Fuller, Amerada Petroleum Corporation, for North Dakota; Ray Wright, Sinclair Oil and Gas Company, for Colorado; R. E. McMillen, Ohio Oil Company, for Nebraska; R. W. Gemmer, Carter Oil Company, for Montana; and L. S. Fuller, El Paso Natural Gas Company, for Utah. Richard Armstrong, Oil Well Supply Company, was elected secretary-treasurer for the district.

Election of new officers was held at the spring meeting at Casper, Wyo.

Announcement was also made of the recipient of the first $500 scholarship award to be given yearly to a petroleum engineering student in a regional school by the Rocky Mountain district. Recipient of the award was Robert D. Emery, Golden, Colo., a junior at the Colorado School of Mines.

Summer Course to Be Held In Reservoir Engineering

A. F. Van Everdingen, chief reservoir engineer of the Shell Oil Company, Houston, will be one of the principal lecturers at the graduate summer course in reservoir engineering to be given August 26 through September 15 at the University of Texas. Sponsored jointly by the Institute for Advanced Engineering of the University of Texas and the Southern Regional Educational Board, the course is entitled "Performance Prediction of Several Reservoir Mechanisms."

The course is limited to an enrollment of 55 students and carries a credit of three semester hours. Other instructors will include Professors H. H. Power and E. W. Hough of the Department of Petroleum Engineering and Professor W. T. Guy of the Department of Mathematics.

API Mid-Continent Officers Elected at Spring Meeting

Chairman, vice chairmen for the various districts and secretary-treasurer of the Mid-Continent district, American Petroleum Institute Division of Production, were elected at the closing session of the spring convention.

Jack Tarner, Phillips Petroleum Company, was named district chairman. Vice chairmen named were Charles Galloup, Natural Gas Pipeline Company of America, Panhandle area; E. E. Young, Sohio Petroleum Company, Seminole-Oklahoma area; J. Clifford McClure, Cities Service Oil Company, Kansas; G. G. McKenney, Dowell Incorporated, Drumright-Perry area; Bliss Adamson, Halliburton Oil Well Cementing Company, southwestern Oklahoma; Ben LaLonde, Phillips Petroleum Company, Golden Trend area.

Jake Easton, National Tube Company, was named secretary-treasurer.

National Safety Council Appoints Industrial Manager

David L. Arm, dean of the School of Engineering at the University of Delaware, has been appointed manager of the Industrial department of the National Safety Council. The development and administration of occupational safety services for nearly 5000 industrial members with more than nine million employes led to the formation of the Council and is still the backbone of the Council's broader operations.

Lt. Gen. E. O. Thompson, right, presents gifts to long-time oil editor Norman Dana Bartlett on behalf of Panhandle area oil men.

Texas Panhandle Oil Men Honor Amarillo Editor

Norman Dana Bartlett, oil editor of the Amarillo News-Globe, Amarillo, Texas, recently received two engraved trays from Panhandle area oil men. Presented by Lt. Gen. E. O. Thompson, senior member of the Texas Railroad Commission, at the closing banquet of the Mid-Continent district, American Petroleum Institute, Division of Production, the gifts were given in behalf of the Panhandle Chapter, API, Panhandle Producers and Royalty Association, Panhandle Geological Society and the Amarillo Chapter, Desk and Derrick Club.

Bartlett has been oil editor of the Amarillo News-Globe for nearly 30 years.

N. V. Hendricks to Head Industrial Hygiene Group

N. V. Hendricks of Esso Research and Engineering Company has been elected president of the American Industrial Hygiene Association. The group was organized in 1939 to stimulate study and control of environmental factors affecting the health of industrial workers and for related purposes.

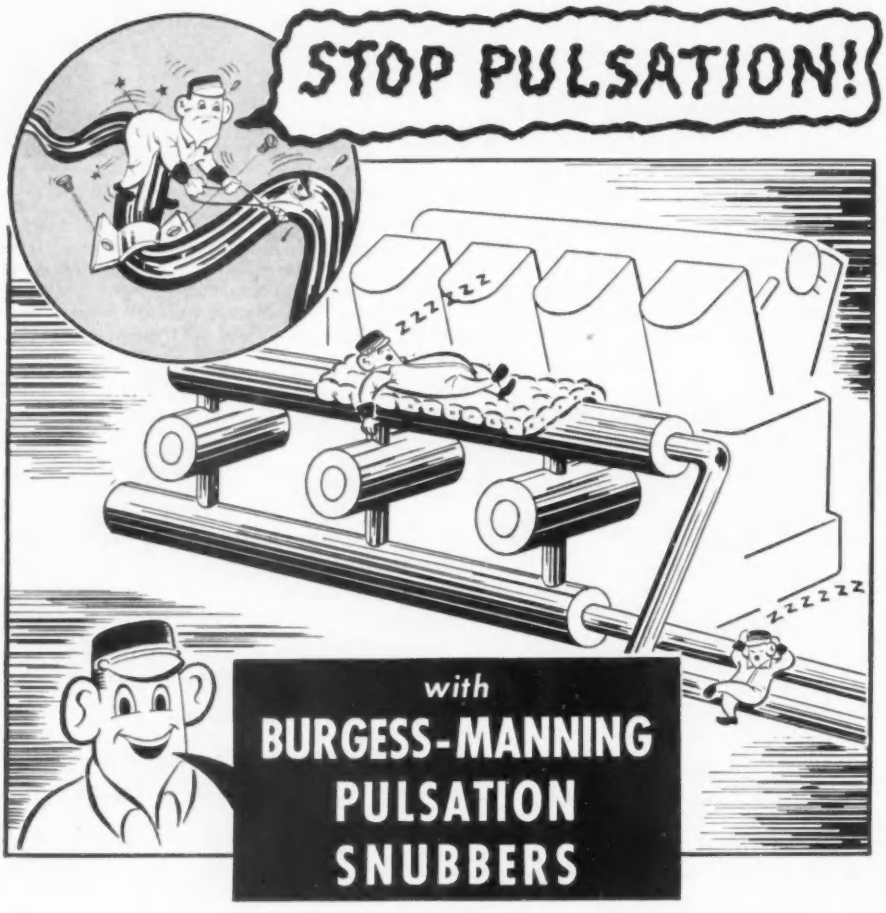
N. V. Hendricks

Hendricks heads the industrial hygiene activities in the Medical Research division of his firm. He is a lecturer on the staff of the Institute of Industrial Medicine of the New York University Postgraduate Medical School and also at the School of Public Health of Harvard. He was previously assistant director of the Division of Industrial Hygiene, Georgia Department of Health, and assistant professor of industrial hygiene at the Georgia Institute of Technology.

Michigan Petroleum Group Elects Loupee President

B. L. Loupee, Service Oil Company, Cassopolis, was elected president of the Michigan Petroleum Association at the 21st annual spring convention. He succeeds A. L. Truesdell, J. Austin Oil Company.

Other officers chosen were: Vice president, Frank Fehsenfeld, Crystal Flash Petroleum Corporation; secretary, V. H. Kellerman, Star Oil Company; treasurer, Ferris Rennie, Rennie Oil Company; executive secretary and general counsel, Joseph Hadley, Detroit.



Burgess-Manning Pulsation Snubbers will remove one of your most aggravating and costly bug-a-boos, that of line surges from compressors, pumps, blowers, etc. Maintenance and service costs will drop sharply — lines and associated equipment will operate at a new efficiency — flow control can be greatly improved. Structural supports of pipe lines need no longer be of costly and special construction — gas compressors and pumps will deliver full design flow with greatest efficiency in pulse-free piping.

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Sound Engineering

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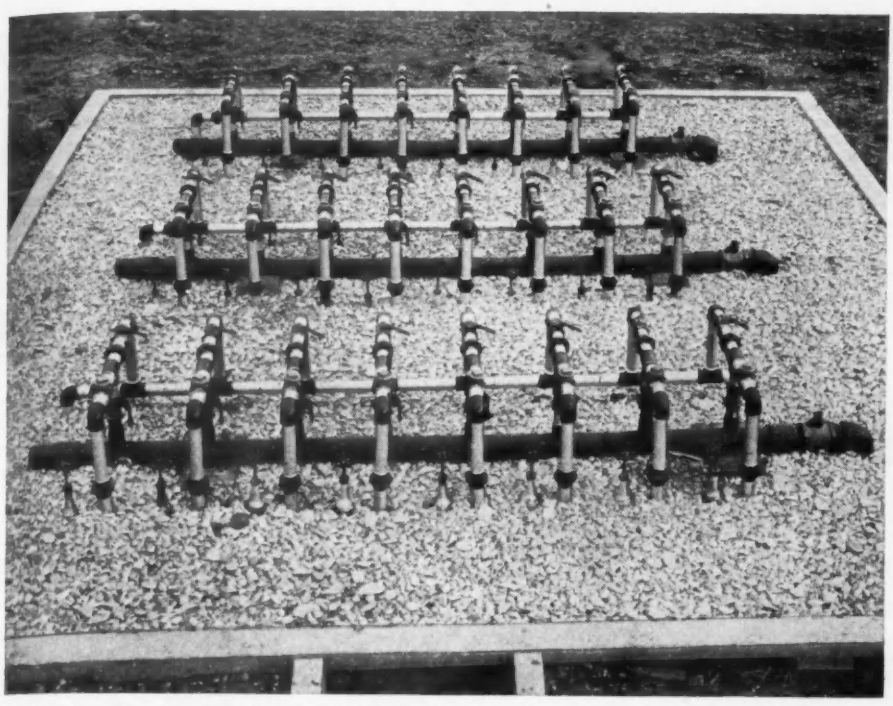

Unitizing Production from 24 Wells in water-flood operation. Production header equipped with 48 2-inch and 3 4-inch, fast-opening, Mudco Butterfly Valves. Critical shafts and set screws are Monel protected against salt water corrosion.

Improving reliability of equipment handling corrosive brines

Mudco uses Monel for critical parts of self-cleaning butterfly valves

In recent years, marked improvements have been made in the performance of equipment handling brines or combinations of brines and sour crudes.

One reason is the increasingly wide use of Monel® for critical parts. Monel is used, for example, for disc fastenings and shafts in the 51 self-cleaning Mudco Butterfly Valves employed in the production header shown above, to handle a mixture of crude oil and salt water.

In shafts and disc fastenings for this type valve, Monel provides an economical combination of corrosion resistance, machinability and strength.

Proves Essential In Many Areas

"In the oil country," says Mr. R. D. Baker, Manager of the Equipment Division of Mud Products, Inc., "Mudco O-ring Butterfly Valves are widely used in salt water disposal systems as well as water-flood operations. This service is particularly severe in a great many areas, and we have found that in order to accomplish satisfactory performance, Monel shafts and set screws (or bolts) are essential."

Improves Other Equipment, Too

Better performance has followed the use of Monel in many types of equipment exposed to brines and sour crudes. Monel is used, for instance, in barrels and internal parts of mechanical bottom-hole pumps, in well-survey instruments, in polished rods and in routing valves. In electrical bottom-hole pumps, "K"® Monel provides an extra measure of strength.

Monel has successfully overcome the added complications of salt-laden atmospheres and mechanical abuse in marsh buggies, sheathing for offshore structures, and cable and cable armor.

Do You Have Corrosion Problems?

If so, you can get objective assistance in finding causes and developing economical answers by contacting Inco's Corrosion Engineering Section.

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Monel...*for minimum maintenance*

Reliable Performance. Monel shaft and dog-point set screws help give this Mudco Valve long life in brine and sour crude environments. Valves are self-cleaning, self-lubricating; have low head loss. They may be given a new-valve status with on-the-job replacement of parts . . . ordinarily simple renewal of the O-ring. (For further information, contact Mud Products, Inc., Philtower Building, Tulsa, Oklahoma.)

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DEATHS

James Kenneth Murphy, 55, prominent geologist, died in Tulsa March 22. He formerly was secretary-treasurer and geologist for the Nerbla Oil Company and president of the Miners Oil Company. He had been an independent consulting geologist since the Miners firm was dissolved in 1952.

William A. Roberts, 57, president of Allis-Chalmers Manufacturing Company, died April 12. He began his career with the company in 1924 as a salesman in Wichita, Kansas. He was made executive vice president in charge of the tractor division in 1947, and the next year became a director and a member of the board's executive committee. He was elected president in 1951.

Albert A. Gilbert, 87, retired Sinclair Oil and Gas Company district foreman, died April 26 in Jennings, Okla. He began working in the Kiefer and Okmulgee oil fields in 1908 and moved to Drumright and then to Jennings in later years where he was employed by the Prairie Oil and Gas Company, and later the Sinclair firm, its successor.

Dr. Fred Severs Clinton, 81, one of the first two men to drill for oil in Tulsa County, died in Tulsa. A physician and oil man, he was associated with Dr. J. C. W. Bland in drilling the first oil well in the Tulsa district June 26, 1901, in Red Fork.

Paul L. Meaders, independent operator, died in San Antonio. He had oil interests in several states, and was formerly associated with John J. Sherrin of San Antonio, one of the founders of the LaGloria Corporation.

William Henry Case, 78, retired division superintendent of Gulf Oil Corporation, died recently in Tulsa. He was formerly with Matson Oil Company and Gypsy Oil Company. In 1925 he took charge of the southern district operations for Gulf, and remained as supervisor until 1941 when he retired.

E. L. Caster, 58, died recently in Shreveport, La. Veteran manager, Exploration division, Arkansas Fuel Oil Corporation, he was previously with a subsidiary of Royal Dutch Shell in Mexico and Empire Oil Company in Kansas. He joined Arkansas Fuel as production engineer in 1929.

Herman D. Cornell, 67, independent oil operator, died in Fort Worth. Starting in the oil business in Tulsa, he was active in the development of the Ada field. He was a partner in a drilling company and had crude oil producing properties in Oklahoma and Texas.

James L. Snedden, 84, retired oil man and longtime Tulsan, died April 26 in Tulsa.

Baron S. Barnes, 59, veteran drilling contractor and oil producer, died in Chicago. When associated with the late Frank P. Zoch, Barnes drilled many wells in Oklahoma and the Texas Panhandle field and was among the pioneers in the Doyle pool of Stephens County, Okla.

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PROTECTION
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51-05 Pants
53-15 Hat

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Wears like iron — takes endless rubbing, scraping, snagging, and still gives full protection.
100% Waterproof — made with top quality base fabric saturation-coated first and then coated with 6 coats of Neoprene Latex.
Positively will not blister, crack or peel. Its longer lasting quality means greater economy.
Also: Three-quarter and long coats, aprons, coveralls and many other styles. All clothing made in black or yellow.

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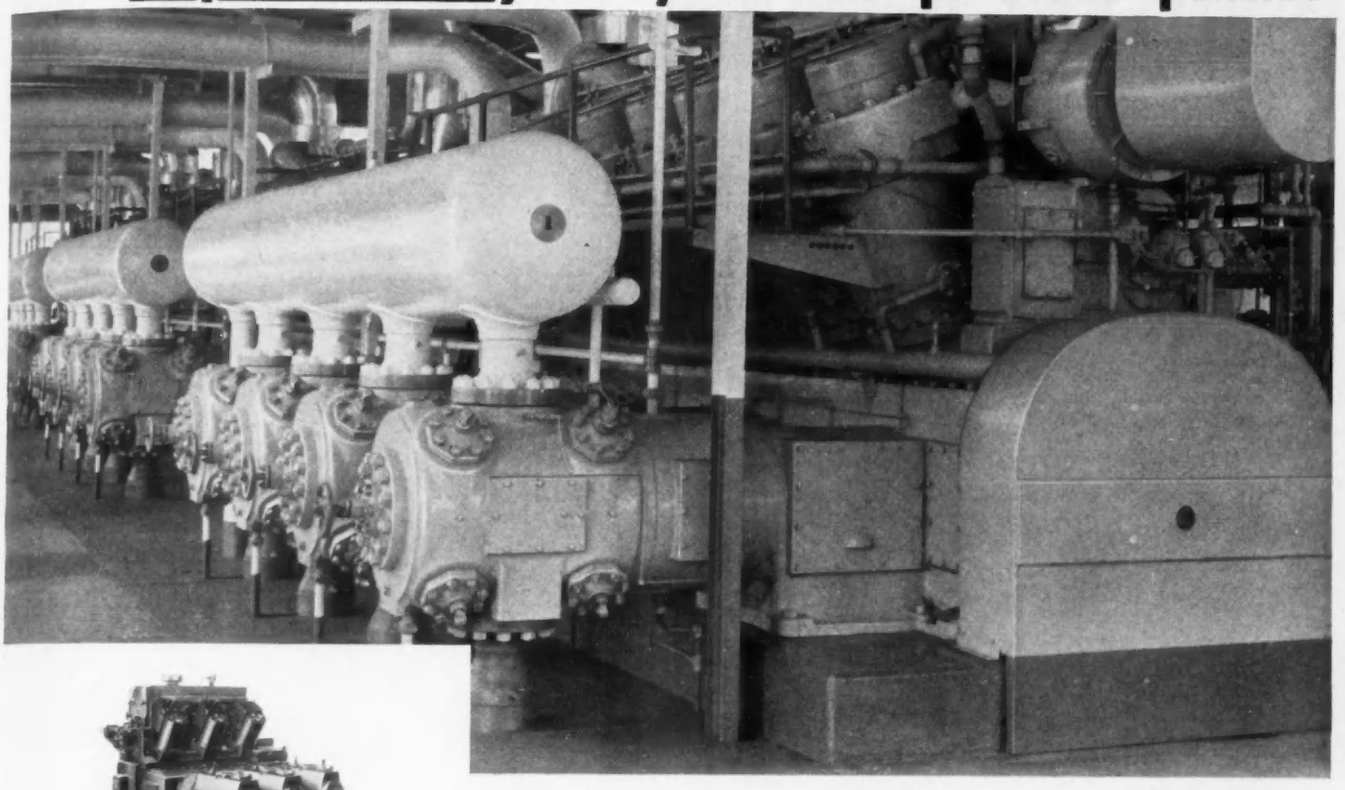
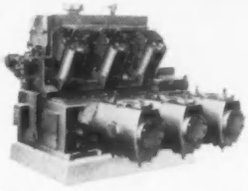
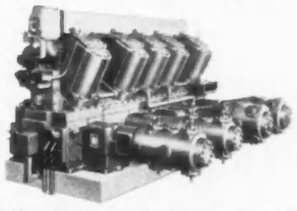
Put *dependability* in your compressor plant!



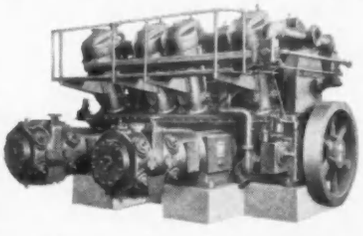
Seven of the first turbocharged gas-engine compressors — These 2000-hp KVS units are giving excellent service at a large southwestern gasoline plant.



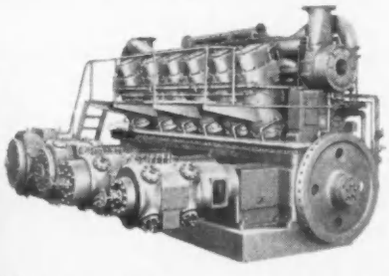
JVG—110, 165 & 220 hp



SVG—330, 440, 550 & 660 hp



KVG—660, 880, 1100 & 1320 hp



KVS—2000 hp (TURBOCHARGED)

Well-known 4-cycle V-angle design now available up to 2000 horsepower

What will you demand of your next compressor installation? Chances are your first requirement will be *dependability* — the ability to take continuous tough operation plus the reserve power to meet extra needs without trouble.

The I-R monogram, backed by over 75 years of compressor-building experience, is your assurance of dependability. Ingersoll-Rand, the nation's oldest and leading compressor manufacturer, proudly points to thousands of successful installations as proof of the confidence of its customers.

With the introduction of the turbocharged KVS, Ingersoll-Rand 4-cycle, V-angle gas-engine compressors are now available in a full range of sizes from 110 to 2000 hp, with complete flexibility of compressor cylinder design and arrangement. As companion units, I-R builds gas engines for driving generators, pumps, blowers and similar equipment.

Get this traditional I-R dependability that means greater economy in the long run. Consult your Ingersoll-Rand representative today. He can be of valuable help to you.

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PUMPS • COMPRESSORS • GAS & DIESEL ENGINES
TURBO-BLOWERS • VACUUM EQUIPMENT • AIR & ELECTRIC TOOLS

6-142

What's Happening

AMONG SERVICE AND SUPPLY MEN

Roy Woodside

Paul Nagle

Louis C. Rove

William C. Young

J. H. Pettit

Douglas McGuffin

Jack N. Yetter

J. T. Tucker

William D. Gilder

D. M. Jacks

W. H. Kirkpatrick

T. R. Fullinwider

Roy Woodside has been appointed vice president of **Dunham Tanks** in charge of the Texas Gulf Coast division. He has been serving in oil field processing equipment as a sales engineer. Assisting at the division office in Houston are sales engineers **Frank Black** and **A. E. (Swede) Erickson.**

Joy Manufacturing Company has announced the promotion of **Paul R. Nagle** to export manager for the Baash-Ross Tool Company. Having served as assistant export manager for the company during recent years, Nagle has had wide experience in the oil industry, familiar with domestic operations and the varied requirements of overseas operations.

Louis C. Rove has been appointed district manager of the Great Lakes territory of **Nordberg Manufacturing Company,** replacing **William C. Young,** recently transferred to Industrial and Petroleum Sales. Rove joined Nordberg's Engineering department in 1920 and progressed up through the industry. He was active in the capacity of special representative until his new appointment. Young joined the company in 1940 as a cooperative student. He was made Great Lakes district manager in 1954.

J. H. (Jack) Pettit has been appointed head of **Sargent Engineering Corporation's** Oil Tool Merchandising division, with headquarters in Huntington Park, Calif. He was formerly district manager of Sargent's Kansas-Illinois district. Pettit entered the oil tool field in 1934, serving with International Supply Company and, later, with Jones & Laughlin Supply Company. He joined Sargent in 1942 in the general sales office in Tulsa.

Douglas McGuffin has been made sales engineer in the Williston Basin area for **McCullough Tool Company.** He was formerly in the company's service department. Before joining McCullough in 1954, McGuffin was with Byron Jackson Service Company.

Jack N. Yetter is the new sales manager, General Products division of **Twin Disc Clutch Company,** replacing **E. C. Billings** who recently retired. Yetter has been with the company six years, beginning as district sales engineer in the Tulsa office in 1949. Prior to his new promotion, he was sales promotion manager. Two district sales engineers who recently joined the company are **Jimmie C. Ellison** and **Gifford James.** Ellison will assist the district manager in the Tulsa office, and James will assist the manager in the Texas district office.

J. T. Tucker recently joined **George E. Failing Company** as general manager of sales. He was formerly general manager of sales with Emsco Manufacturing Company and was vice president in charge of sales for the Unit Rig Company. **K. W. Paterson,** former vice president in charge of manufacturing with Unit Rig and Equipment, has joined Failing as assistant to the president. At one time he was also with Emsco Manufacturing, as production manager and administrative coordinator.

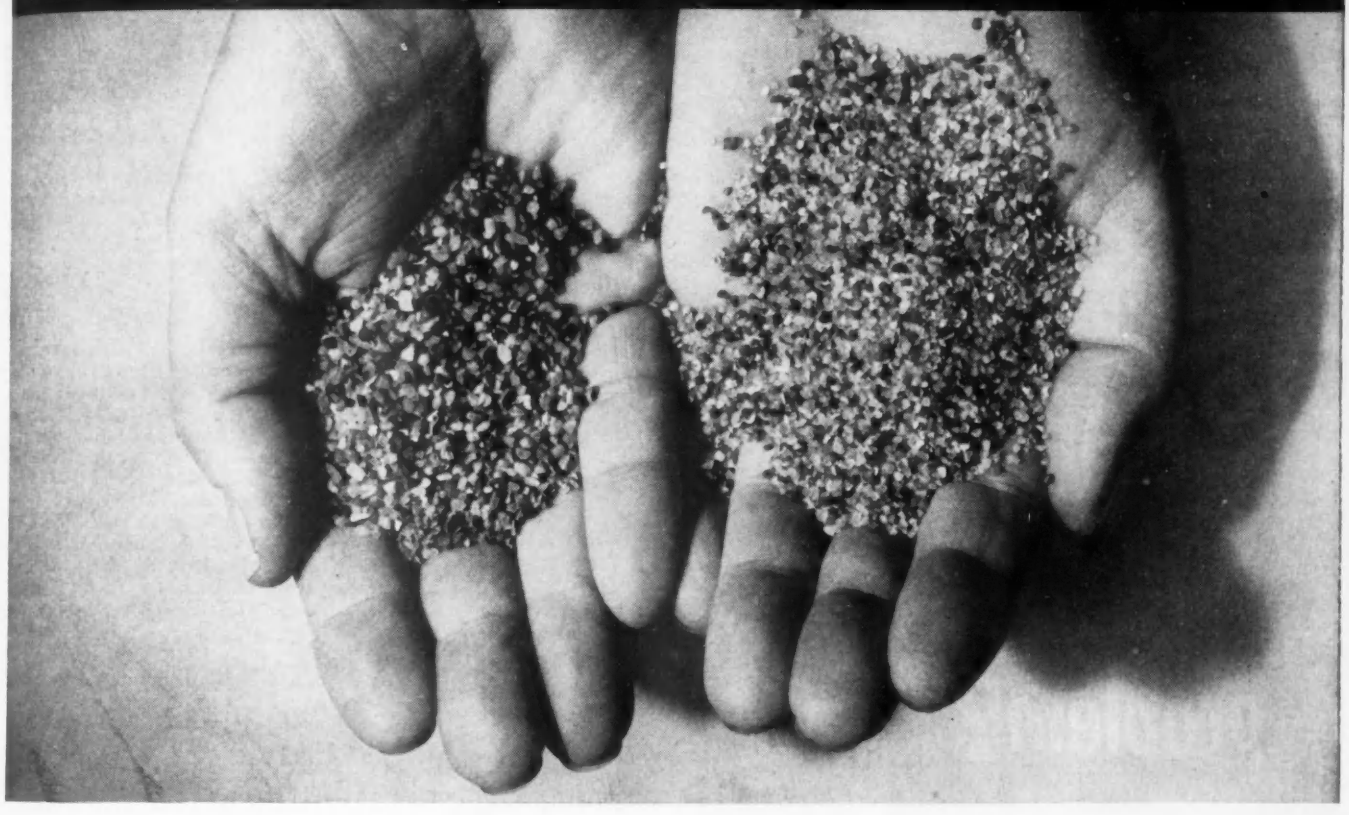
William D. Gilder, metallurgist from Cleveland, Ohio, became associated with **Reed Roller Bit Company** as chief metallurgist April 1. In the metallurgical field for 24 years, Gilder was last associated with the Weatherford Company of Cleveland.

D. M. Jacks has been promoted to the office of vice president of **Visco Products Company, Inc.** He joined the company in 1937 as a junior salesman in the Houston territory. In 1943 he was named sales manager, with headquarters in Houston, and in November, 1952, was named assistant vice president. In addition to serving as vice president, Jacks will continue to operate in his present capacity as sales manager with headquarters in Houston. **Dr. W. H. Kirkpatrick,** assistant vice president, also has been promoted to the office of vice president of Visco Products. He joined the company in 1937 as chief chemist and plant manager with headquarters in Sugar Land, Texas. In 1952 was promoted to assistant vice president. He will continue in his present capacity as technical director as well as serving as vice president. His headquarters are in Sugar Land.

T. R. Fullinwider has been named domestic oil field sales manager of **Mission Manufacturing Company.** Formerly assistant to the domestic sales manager, he has been with Mission seven years.

Unit Rig and Equipment Company has promoted **John Tullis** from plant superintendent to technical staff assistant to the president, **Elmer Clever,** from assistant shop superintendent to shop superintendent; and **L. R. Jestus** to production manager. Prior to joining Unit Rig in 1952, Tullis was assistant chief engineer with National Zinc Company. Clever was associated with Emsco Manufacturing Company for 21 years and was assistant plant manager when he resigned in 1954 to join Unit Rig. Jestus was superintendent of production planning with Minneapolis-Honeywell before joining Unit Rig in 1952.

SIZE of gravel IS important



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Every well requires individual treatment and the size of the Gravel used is important. This has been a Layne specialty for many years.

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Rodney S. Durkee

H. P. Boncher

W. D. Miller

F. G. Fabian

J. H. Loomis

Frank Smith

Rodney S. Durkee has been elected to the board of directors and appointed to the executive committee of **Dresser Industries, Inc.** He is chairman of the board of the Lane-Wells Company, recently acquired by Dresser. He joined Lane-Wells as executive vice president in 1938 and has been the company's president since 1939. **H. P. Boncher,** who has been general manager of Dresser Manufacturing division since 1942 and a vice president of Dresser Industries, Inc., since 1951, has been named operating vice president of Dresser. He will have responsibilities for Dresser Manufacturing Division, Bovaird & Seyfang, Clark Bros. Co., Dresser-Ideco Company, Pacific Pumps, Inc. and Roots-Connersville Blower division. **W. D. Miller,** whose previous experience includes ten years in an executive capacity with Creole Petroleum Corporation in Venezuela, joins Dresser as an operating vice president with responsibilities for Magnet Cove Barium Corporation, Lane-Wells Company, Security Engineering Division and Ideco Division. Both Boncher and Miller will headquarter at Dresser's general offices in Dallas. Boncher will be succeeded in his position as general manager of Dresser Manufacturing division by F. G. Fabian, Jr. who joined the company as his assistant in 1953.

J. H. Loomis has been appointed manager of **Worthington Corporation's** St. Louis office. Formerly general line salesman and compressor specialist at the Chicago district office, he joined the company at the Buffalo Works Compressor division in 1954. **P. A. Mack,** former manager of the St. Louis office, has been appointed special representative and will devote full time to the development of business through special customers and assignments. Associated with Worthington for 40 years, Mack served as manager of the St. Louis office for 23 years prior to his present appointment.

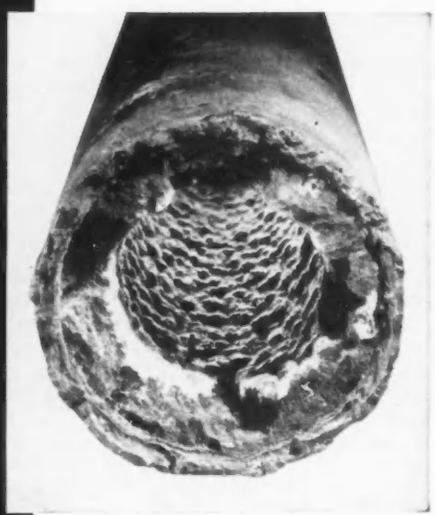
Frank Smith has been appointed manager of the newly-created South Louisiana district of **Oil Center Tool Company.** His headquarters will be in Lafayette. Smith was a salesman for O-C-T in Odessa, Texas, for three years. He has been a sales representative since 1953.

Fred S. Shumaker has been named district representative of the Michigan sales area for Leschen Wire Rope division, **H. K. Porter Company, Inc.** The territory covers the lower peninsula of Michigan and part of the upper peninsula. Shumaker has been with wire rope distributors in the Detroit area for 13 years, a part of that time with his own company.

Lane-Wells Company has made the following changes in the Gulf Coast division: **Jerry Maurice,** formerly truck station superintendent at Falfurrias, Texas, has been promoted to station superintendent at Haskell; **Harry Johnson,** previously station superintendent at Haskell, has been transferred to Gainesville as station superintendent; and **Nathan Milliman,** formerly station superintendent at Gainesville, has been transferred to Hobbs, N. M., on an operating assignment. The Falfurrias truck station has been closed. The Vivian truck station has moved into new quarters on South Pine Street.

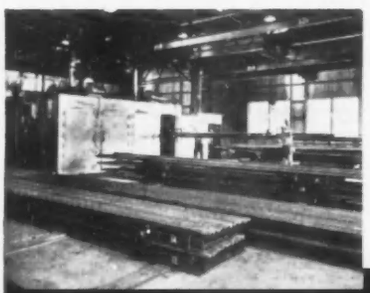
PARAFFIN your problem?

...Then Read This:



A Louisiana oil company had an uncoated string of 2" EUE tubing that plugged in three days. Tubing lined with TK-2 plastic was installed and is working perfectly, even after eight months.

A Texas company experienced heavy paraffin accumulation in flow lines and had to use hot oil circulation as frequently as twice weekly. Tube-Kote lined pipe was substituted and has been in service six years without trouble.



Tube-Kote plastic linings can solve your paraffin *and corrosion* problems, too. WRITE TODAY FOR ILLUSTRATED BROCHURE ON TK-2 PLASTIC LININGS.

TUBE-KOTE T.M. REG.

▲ Some of the huge bake ovens where TK-2 plastic is bonded to pipe internal surface.

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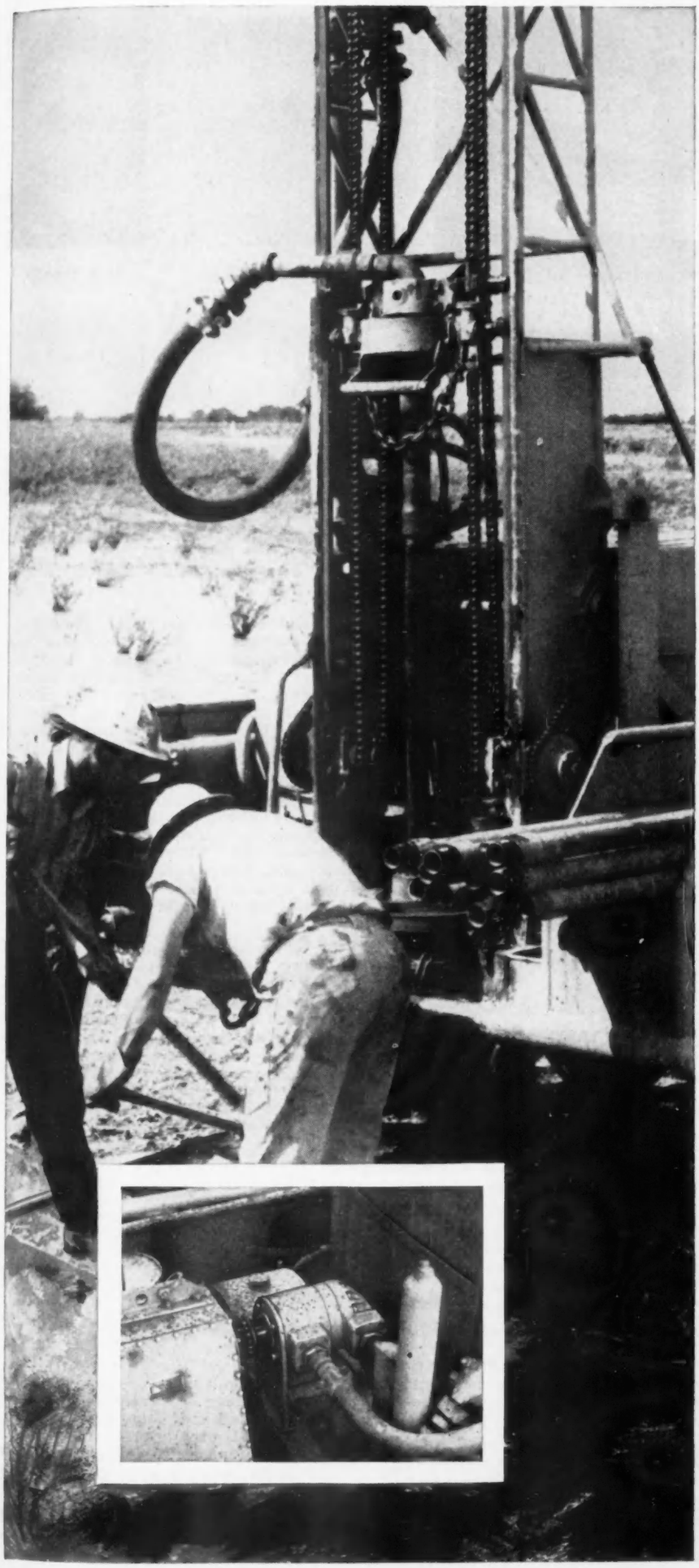
Pioneers in plastics since 1939 . . . manufacturers-extruders of plastic pipe for the oil industry. Factory trained field engineers available for consultation in all principal oil areas.



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Speed and ease of drilling by hydraulics does it.

Here's how The Superior Oil Company, Houston, has modernized and simplified a shot-hole rig to drill faster, easier. A Denison Pump/Motor furnishes hydraulic pressure to raise the mast . . . and also drives another Denison Pump/Motor for the drill pull-down.

The pump/motor used for the pull-down is only 9 inches long, weighs only 19 pounds . . . *yet has enough power to actually lift the truck off its wheels.*

For drilling, for many other oil industry applications, look to Denison hydraulics for faster, easier-operating, lower-cost power equipment. Send for latest bulletins on Denison hydraulic pumps, motors and controls. Write to: THE DENISON ENGINEERING COMPANY, 1248 Dublin Road, Columbus 16, Ohio.

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William L. Wolfe

N. H. Ottinger

L. R. Latimer

Leonard F. Cowan

William L. Wolfe has been appointed vice president-sales of **Jones & Laughlin Steel Corporation's** Supply division, with headquarters in Tulsa. Since 1953, he has been assistant to the vice president-sales of J&L at the general office in Pittsburgh. Wolfe's new appointment comes after 18 years with J&L. His first appointment, in 1937, was open hearth control chemist at the Aliquippa Works in Pennsylvania. A year later he entered the company's sales training course, and in 1939, he became sales correspondent in the Wire Sales department. In 1951, after several sales promotions, he was appointed assistant manager of sales-tubular products, in charge of oil country tubular goods.

N. H. Ottinger, appointed to the recently-created position of division logging engineer for **McCullough Tool Company's** Mountain division, will cover the territory encompassing Colorado, Montana, North and South Dakota, Utah, Wyoming and Nebraska. Prior to joining McCullough Tool, Ottinger was with Sinclair Oil and Gas Company as senior geophysicist. From 1937 to 1953, he was with Schlumberger Well Surveying Corporation.

L. R. Latimer is now eastern sales manager for **Parkersburg Rig and Reel Company.** Recently promoted from area manager, he will continue to be located at Parkersburg, W. Va.

Gulf Coast Machine & Supply Company has named **Leonard F. Cowan** head of the new district sales office in Dallas. Cowan was formerly Gulfco's district manager at Wichita Falls.

Wilfred Sykes, former president of Inland Steel Comapny, has been elected to the board of directors of **Lone Star Steel Company.** After serving as president of Inland, he was chairman of the finance committee of Inland's board. He gave up special committee work on the Inland board to head the Chicago Housing Authority. In addition to retaining his place on the Inland board, he is a director of the Pullman Company.

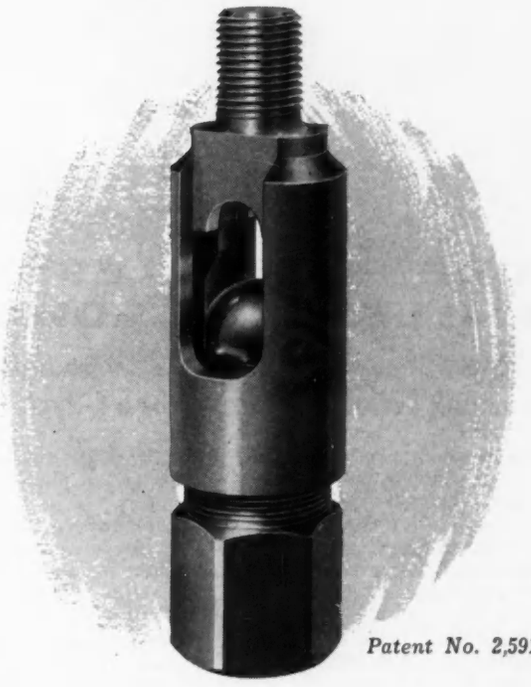
The facts behind the Success of the

MARTIN CAGE

When pencil, paper and manufacturing skill were fused in the development of the Martin Cage, one guiding thought was held constantly in mind. *Make a better cage — a cage which would stand the terrific punishment that caused ordinary cages to fail.*

The result, of course, was the Martin Cage. And today, after years of use by economy-minded producers, this one significant fact remains undisputable. *With Martin Cages, ball and seat life is often doubled . . .* So successful has been the Martin Cage that some manufacturers are attempting to follow in its footsteps. Naturally, only Martin can make a Martin Cage.

The secret of Martin Cage's long life is the oil proof rubber ball guides. The resilience, resistance to sand abrasion, non-magnetic character and electrical resistance of this rubber guide successfully combat cage problems. They are manufactured in open and closed types . . . all diameters and styles. Write for the new John Martin Catalog No. 4, with helpful information on how to select the correct cage for your particular installation.



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Martin Cages are available through all supply stores.

JOHN N. MARTIN
Manufacturer
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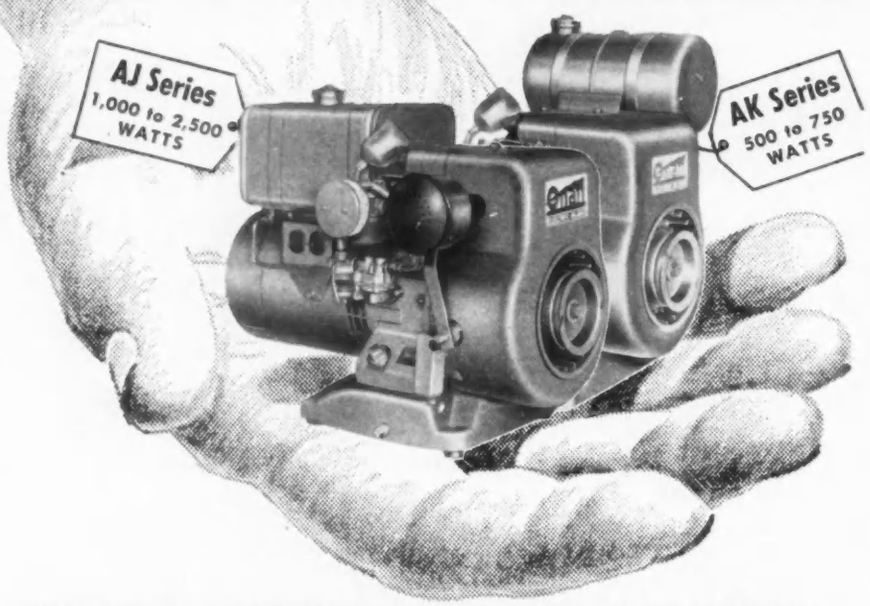
ONAN Announces Two New Series of

POWER PACKED ELECTRIC PLANTS



MORE POWER, LESS WEIGHT, SMALLER SIZE, LOWER COST!

2,500-watt unit weighs only 154 pounds! Gives you more power per dollar than any other 4-cycle electric plant.

Higher output in a smaller, lighter package give these new Onan units marked advantages for every type of service . . . portable, mobile, primary, or emergency standby.

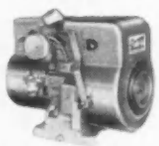
Wherever you use *portable* electric plants, you can now put more cost-cutting electric light and power to work for you . . . at less cost. In *mobile* applications you can take along more power in less space . . . with less weight. In *primary* and *emergency* standby applications you get more power at less cost with all the Onan advantages of quick starting, long life and easy maintenance.

These new units are *completely Onan-built,* with Onan engines direct-connected to Onan generators in a single compact unit. The new, modern, *short-stroke,* single-cylinder, 4-cycle engines feature extra-large bearings and free-breathing intake and exhaust systems to give you thousands of hours of operation without major servicing. Generators are, drip-proof and specially insulated for all-climate, all-season use.

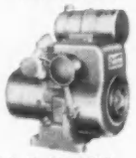
Equipped with carrying frames or two-wheel rubber-tired dollies, Onan AJ and AK series electric plants can be taken anywhere . . . moved around easily on the job.

See your Onan distributor or write for new folder describing all 18 new models

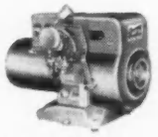
POWERED BY MODERN SHORT-STROKE ENGINES



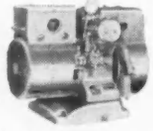
AK *A.C. MODELS* 500 and 750 watts, 115 or 230 volts.



AK *D.C. MODELS* (Battery chargers) 500 and 750 watts, 6, 12, 32 volts.



AJ *A.C. MODELS* 1,000 and 2,500 watts, 115 or 230 volts.



AJ *D.C. MODEL* (Battery Charger) 1500 watts, 32 volts

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

3601 University Ave. S.E., Minneapolis 14, Minnesota

H. T. Anderson

H. L. Hawkinson

T. R. Shields

M. C. Goforth

H. T. Anderson has been named sales engineer in the Pacific Coast territory Heavy Machinery division, **Nordberg Manufacturing Company.** Assisting **C. G. Cox,** Pacific Coast district manager, he will serve California, Oregon, Washington, Idaho, Nevada, Utah and Arizona. Anderson has been design engineer, project engineer, manager of the New York district office and assistant general sales manager for Enterprise Engine & Machinery Company. He was promoted to assistant general sales manager in 1951.

Bethlehem Supply Company has announced the promotion of **H. L. Hawkinson, Jr.** to the new position of division machinery sales manager for the Gulf Coast division. He will be responsible for sales and sales promotion of Bethlehem manufactured drilling equipment and pumping units. His headquarters will be in the division office at Houston.

T. R. (Roy) Shields, sales representative for **Well Equipment Manufacturing Corporation,** is being transferred from Billings, Mont., to the home office in Houston. He will be assigned to sales and service work with drilling and producing activities in the area. Shields has been a member of the WECO sales staff for nine years representing WECO and CHIKSAN in the Rocky Mountain area for the past two years. Prior to that assignment, he was company representative in south Louisiana.

Delta Tank Manufacturing Company has named **M. C. Goforth** sales engineer. Goforth joined Delta in 1954 after three years with Brown & Root, Inc. He earlier served as engineer and sales executive for A. O. Smith Corporation, and from 1936 to 1941, as field engineer and assistant general construction superintendent for the Walter Butler Company of St. Paul, Minn. In 1941 he joined the Ingalls Shipbuilding Corporation on a loan basis, returning to Butler in 1943 as area engineer for midwest and eastern fabricators.

Use Carlon* oil country plastic pipe for LOW-COST disposal lines

Carlon is not affected by salt water.

Carlon resists accumulation of paraffin in gathering lines . . . resists acids.

Carlon remains free of scale and sediment when used for sludge lines.

NOTHING beats Carlon Oil Country plastic pipe for low-cost handling of salt water, sludge, or sour crude gathering. Such installations have saved producers money throughout the industry.

Carlon "L" rigid plastic pipe (types "LOC", "LOU" and "LOH") outlast metal a hundred to one when in contact with corrosive materials.

These high quality plastic pipes come in easily assembled, light-weight 20-foot and 30-foot sections for which suitable fittings are immediately available. And every foot of Carlon "L" is unconditionally guaranteed against rust, rot, electrolytic corrosion.

*®

The smooth plastic walls are unwettable . . . provide a higher flow rate than comparable metal sizes. For the same flow rate you can get with a given size in metal pipe, you can use smaller sizes of Carlon "L". . . or you can use lower pumping pressures without serious pressure drop.

And Carlon "L" costs about 10% less than galvanized . . . much less when you consider the lower installation costs and the greatly extended service life.

See your Carlon jobber now and get the complete facts on this stronger, tougher, longer-lasting plastic pipe that can save you enormous sums on piping costs.

USE THIS COUPON

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Cleveland, Ohio

Please send complete information on Carlon Oil Country Pipe together with name of nearest jobber.

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Company _____

Address _____

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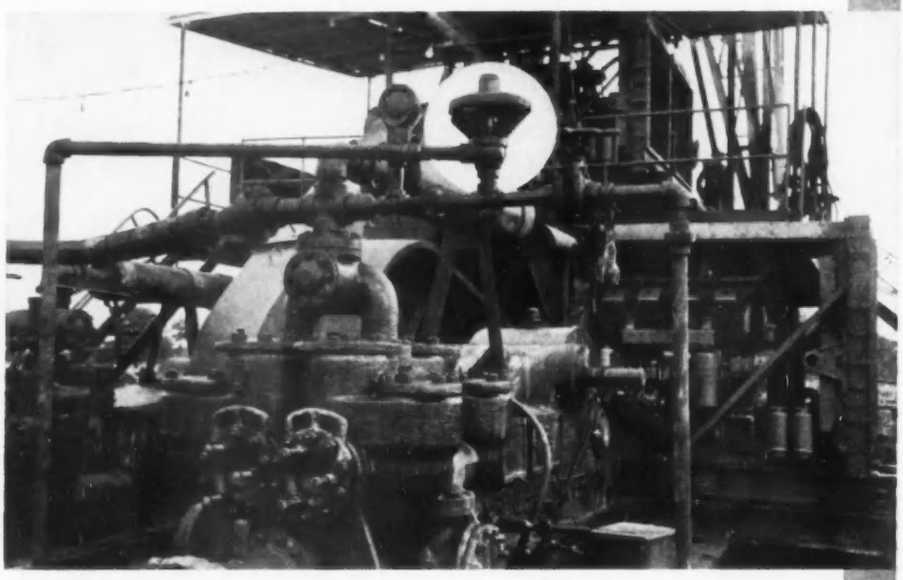
WORLD'S LARGEST MANUFACTURER OF PLASTIC PIPE

Plants at Corsicana, Texas; Cleveland, Auburn Corners and Upper Sandusky, Ohio; Asheville, North Carolina; Denver, Colorado; Klamath Falls, Oregon, and Acton, Ontario, Canada. Research Center in Mantua, Ohio

Only KINZBACH

Automatic Mud Relief Valves provide complete protection for personnel and equipment



Danger to personnel, damage to hole and equipment are ever-present hazards of excessive pressures. In each case the danger is cut to a minimum when you install Kinzbach Model 112 Relief Valves. They open automatically and instantly when the line pressure goes beyond safe limits—and when the pressure drops to a predetermined level, they close automatically.

The 112 is easily set to open at any overload pressure and the setting is exact. There's no guesswork whether it is too high or too low. When the line pressure goes beyond this pre-set limit, the valve opens automatically and instantly. When the line pressure is reduced, the valve automatically closes. If desired, a warning horn may be attached to signal while overload pressure is in the line.

The fast and automatic action of the Model 112 Valve protects personnel from bursting hoses, couplings, and valves caused by runaway pressures; and protects equipment from overload damage. It also greatly reduces the possibility of hole damage by allowing the driller to keep pressure in the circulating system during a momentary block, such as might occur from spudding into bottom.

Modern drilling practices demand the complete protection offered by Kinzbach Model 112 Valves. Write today for complete literature, or order through your supply store. Available in 2" and 3" sizes, from 500 p.s.i. to 4500 p.s.i.

KINZBACH TOOL CO., INC.

KINZBACH TOOL CO INC

P. O. BOX 277
HOUSTON, TEXAS

Export Office:
74 Trinity Place,
New York, N. Y.

R. S. Stevenson

Bruce Deters

R. H. Koehler

R. S. Finn

Robert S. Stevenson has been elected president of **Allis-Chalmers Manufacturing Company** to succeed the late William A. Roberts. Stevenson has been executive vice president of the company since July, 1952. He started with Allis-Chalmers in 1933 as a salesman in the Tractor division at the Kansas City, Mo., branch. He was appointed vice president in charge of the Tractor division in February, 1951. Later that year Stevenson was elected to the board of directors. In July, 1952, he was appointed executive vice president. **R. H. Godeke** has been named manager of a new Allis-Chalmers General Machinery division branch office in Corpus Christi, Texas. He joined the company in 1940 and has been a representative in the San Antonio district office since 1947.

Johnston Testers, Inc. has announced the appointment of **Bruce Deters** as service and sales representative in foreign fields. With the company since 1939, he was formerly general service manager of U. S. operations.

Richard H. Koehler has been appointed director of advertising and publicity for **Westinghouse Air Brake Company.** He moves up from the post of advertising and sales promotion manager at the company's Le Roi Division in Milwaukee, Wis. He succeeds **Joe H. Serkowich** who recently resigned. Before joining Le Roi over two years ago, Koehler served for four years as advertising manager of Stearns Magnetic, Inc., Milwaukee. He also worked in similar capacities for several consumer goods manufacturers.

R. S. Finn has been elected to the board of directors and **Albert J. Barthelmes** has been named executive vice president of **Seismograph Service Corporation.** Finn is vice president of Lorac Service Corporation, a subsidiary, and Barthelmes has been serving as a vice president of SSC.

George C. Allen has been transferred from Parkersburg's Houma, La., branch to Maracaibo, Venezuela. He will serve as sales representative in western Venezuela, Colombia and Peru.

A 118 Year Old Company Changes its Name

AMERICAN LOCOMOTIVE COMPANY is now

ALCO PRODUCTS, INCORPORATED

Why this change in a name so widely recognized and long established?

To our many employees and customers —those who know us best—the change is a logical one . . . one that many felt was a long time coming.

Our company has expanded its activities and diversified its products until our former name applied only to a part of our business. It no longer represented our new operations, which have grown beyond our important responsibility as a locomotive supplier.

Look at last year, for example . . .

In 1954, we introduced 18 new products for the chemical, petroleum, power, railroad, and atomic energy markets.

That alone underscores the obvious fact that we are no longer a specialty company but have become one of America's broadly based industrial manufacturers.

So today, this new name has been adopted to reflect the vigorous new company that stands behind it. To our many friends, of course, we have been known for years as "Alco"—now it is official.

And we shall continue to produce traditional "Alco" quality in our new as well as our long-established product lines.

ALCO

ALCO PRODUCTS, INCORPORATED

FORMERLY AMERICAN LOCOMOTIVE COMPANY

New York, N.Y.

Sales offices in all principal cities. *Manufacturing plants* in Schenectady, Auburn, and Dunkirk, New York; Latrobe, Pennsylvania; Chicago Heights, Illinois; Cincinnati, Ohio; and Beaumont, Texas. *Sales Representatives* throughout the World

Robert D. Clark

William A. Carroll

James E. Farrell

Robert Brewster

J. P. Gregor

John Watts

Robert D. Clark has joined **Page Oil Tools, Inc.** as chief engineer in the Long Beach, Calif., plant. He was formerly a development engineer in the Research and Process department of the Union Oil Company of California.

Franklin Supply Company has announced promotion of three district managers. **William A. Carroll**, formerly Tulsa district manager, has been appointed district manager for Oklahoma and Kansas, with offices in Tulsa. **James E. Farrell** has been named district manager of south Texas, Texas Gulf Coast and Louisiana. He was formerly Houston district manager. District manager of east, north, central and West Texas is **Robert Brewster**, formerly district manager of Oklahoma City. He will be located in Dallas.

J. P. (Jack) Gregor has been appointed general merchandise manager for **Unit Rig & Equipment Company.** He will be in charge of all distributor relations including units and parts stock control and distribution. Gregor joined Unit Rig in 1953 as field sales engineer at Oklahoma City and was later transferred to Tulsa as assistant to the vice president of sales.

John Watts, Humble Pipeline Company corrosion engineer since 1948, has been named technical representative of **Internal Pipeline Maintenance Company**, licensee for the Pipeline Process of internally cleaning and coating pipe lines in place underground. He is president of the Permian Basin chapter of the National Association of Corrosion Engineers and chairman of NACE Unit Committee T-2F in internal sour crude corrosion in pipe lines and tanks.

Ray E. Parry, formerly with Clark Bros. Company in Olean, N. Y., has joined the **France Packing Company** as sales representative. Parry joined the Clark Engineering department after World War II and served in various capacities up to assistant department manager.

Geophysical Service Inc. has announced the appointment of **E. O. Vetter** to the position of vice president, administration. Formerly assistant vice president in charge of the administrative division, Vetter joined GSI as controller in 1952. Prior to that he served as assistant manager of the organization and cost control division of Standard Oil Company of California.

M. J. Ross has been named manager, export trade, for both the Quaker Rubber Corporation and The Watson-Stillman Company divisions of **H. K. Porter Company, Inc.** Previously Ross was export manager for Quaker, handling all foreign sales of industrial rubber products. Along with Quaker products, he will now handle the hydraulic presses and equipment of Watson-Stillman. Before joining Quaker, he had been manager of the Industrial Rubber Products division of Firestone International.

William F. Braun has been named regional sales manager of the Penn Industrial Instrument division of the **Burgess-Manning Company.** He will maintain factory contact with representative offices throughout the Eastern portion of the U. S. Braun was formerly general sales manager of the J. E. Lonergan Company.

Two 16" 300-lb. Commercial Type CN Orifice Fittings on transmission lines in gas booster station, Refugio, Texas

COMMERCIAL ORIFICE FITTINGS

. . . for CONTROLLED METERING on oil and gas production, transmission and gathering lines

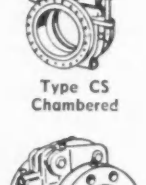
Sturdy construction and simplicity of operation have made Commercial Orifice Fittings a preferred choice in the oil and gas industry since 1930.

TWO CHAMBERED TYPES are available: Type CN, shown in the photo above, in sizes 2" to 20"; 125 lb. to 2500 lb. ASA. Larger sizes are furnished with swinging chamber, designated Type CS.

DEADLINE FITTINGS are available in sizes 2" to 24", 125 lb. to 2500 lb. ASA. High-pressure fittings have pin-locked covers; those for lower pressures are stud-bolted. Larger sizes of both types have geared covers for safe operation.

For more detailed information, see your Composite or Refinery Catalog, or write

Type CS Chambered



Type DPL Deadline

50th Anniversary 1905 1955 25 Years of Orifice Fittings

OUR FIFTIETH YEAR SERVING THE INDUSTRY . . .

COMMERCIAL IRON WORKS

2424 Porter St., Los Angeles 21, Calif.

Distributors . . .

ARKANSAS, KANSAS, OKLAHOMA: The Condit Co., Tulsa 3, Okla.
CALIFORNIA: Fred P. Koenig Co., Los Angeles 15
LOUISIANA: Coastal Engineering Corp., N. Orleans, 13
SOUTH AND EAST TEXAS: Maintenance Eng'r. Corp., Houston 1
NORTH TEXAS: Vickery-Simms, Inc., Arlington
WEST TEXAS, NEW MEXICO: Beal Equipment Co., Odessa
MEXICO: Schultz y Cia., S.A., Mexico 5, D. F.
CANADA: Peacock Bros., Ltd., Montreal, Quebec.

J. E. Jonsson

L. M. Bracewell

J. E. Jonsson, president of **Texas Instruments, Inc.,** has been elected to the board of directors of the Republic National Bank of Dallas. Jonsson joined Geophysical Service, Inc. as superintendent of the Newark laboratory in 1930; in 1934 he was elected secretary of the corporation, and in 1942, was elected vice president. As Geophysical Service expanded, the organization now known as Texas Instruments, Inc. evolved from it. In 1951, Jonsson was named president of Texas Instruments and was elected chairman of the board of Geophysical Service, Inc., a wholly-owned Texas Instruments subsidiary. He now serves also as director in each of the other corporations which make up the Texas Instruments family of companies.

L. M. Bracewell, Jr., has been appointed special salesman for the Gulf Coast division of **Dresser Operations, Inc.** Security Engineering division. Before joining Security, Bracewell had been general manager of Rig Maintenance Supply, Inc. and district manager of Welex Jet Services, Inc.

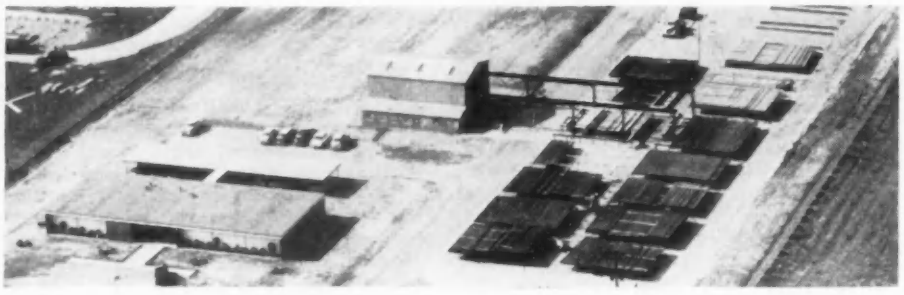
Thad Randolph, former vice president and sales manager of **Oil Base, Inc.,** was named executive vice president and general sales manager of the company at a recent board of directors meeting. He will make his headquarters at the main plant in Compton, Calif. **A. K. Brown,** former Mid-Continent sales manager, was appointed a vice president and division manager. He will operate out of the sales offices in Houston. Two sales engineers who have joined the company are **Hal Farmer** and **Leon Hendrickson.** After a six-week training program at Compton, Farmer will head up the new branch office at Corpus Christi, Texas. He previously was with Union Supply Company, Gardner Brothers Drilling and Baroid sales. Hendrickson will service the Permian Basin for the company's line of oil base drilling fluids, working out of Odessa. He was formerly with Hughes Tool, Baroid and Permian Mud Company.

Weldon L. Crawford has been elected president and treasurer of the **Petty Geophysical Engineering Company, Petty Laboratories, Incorporated,** and **Petty Geophysical Company,** in one of several major executive changes recently announced in the Petty organizations. Crawford has been with Petty since 1932. **P. J. Rudolph** has been elected president and treasurer of the newly-formed **Petty Mining Exploration Company,** and **Herbert M. Dawson,** who has been directing foreign operations of the Petty Geophysical Company, has been elected vice president of that company. Dawson has been with P.G.C. since 1934. **W. Lee Moore,** vice president of the three Petty companies, has also been elected secretary of these organizations. He has been a Petty associate for 25 years.

Byron Jackson Company has announced the election of four vice presidents. **Norman D. Jesse** has been made vice president in charge of sales, service and branches of the Pump division. With the company since 1939, he is now manager of the Eastern branch of the Pump division with headquarters in New York. **Garth F. Nicelson** becomes vice president in charge of the Oil Tool division. He joined the company in 1934 and served as chief engineer of the Oil Tool division, rising to general manager of that division prior to his election as vice president. **Evan H. Sweet** was appointed vice president and counsel. He has been associated with Byron Jackson since 1945 and was office legal counsel prior to his appointment. **Ross Barrett,** made vice president in charge of public relations, advertising and market research, joined the company in October, 1954, as director of public relations.

Jim Whitaker has been named special representative for **Christensen Diamond Products Company,** with offices at 503 Kittredge Building, Denver. He will direct sales, contact and promotional work for the company. For three years Whitaker has directed operations in the Rocky Mountain area as division manager for Christensen. **Hugh Gunn** has been advanced to division manager. Prior to this appointment Gunn was charged with direction of operations in the Casper, Wyo., area. His new duties are expanded to include field supervision of offices in the Rocky Mountain territory.

WHEELING
COUPLINGS
FOR OIL COUNTRY USE
LINE PIPE COUPLINGS A.P.I.
⅛" to 12"—Seamless and Special Processed—Black or Galvanized
PLAIN TUBING COUPLINGS A.P.I.
1" to 4"—Seamless
EXTERNAL UPSET TUBING COUPLINGS A.P.I.
¾" to 3½"—Seamless
CASING COUPLINGS A.P.I.
4½" to 13⅜"—Long or Short
HYDRAULIC COUPLINGS
⅛" to 4"—Seamless
REAMED AND DRIFTED A.I.S.I.
¾" to 12"—Seamless or Special Processed
DRIVE PIPE COUPLINGS
⅜" to 12"—Seamless or Special Processed
Sales Offices in Leading Cities
Albany, N. Y.—Albert L. Becker, 434 Clinton Ave.
Baltimore, Md.—Ted Barto, 2301 N. Charles St.
Chicago, Ill.—Harry A. Jay, Suite 1090, Old Colony Bldg.
Denver, Colo.—Earl H. Jones & Co., 1863 Wazee St.
Erie, Pa.—R. J. Maggi, Box 711
Falmouth, Mass.—Walter S. Bennett, 53 Minot St.
Houston, Tex.—Henry H. Paris Distributor, Inc., Box 932
Los Angeles, Cal.—James A. Riordan Co., 1400 Santa Fe Ave.
Milwaukee, Wisconsin—M. A. Nelson Co., 3347 N. 97th St.
Minneapolis, Minn.—Lin J. Krause, 5605 Lyndale Ave. S.
Narberth, Pa.—J. W. Worthington, 105 Forrest Ave.
Newark, N. J.—Ira L. Rothenberg & Assocs., Industrial Office Bldg., 1060 Broad St.
New York, N. Y.—Max Rothenberg, 11-05 38th Ave., Long Island City
Portland, Ore.—Earl H. Jones & Co., 1233 NW 12th Ave.
Richmond, Va.—P. C. Abbott & Co., 15 E. Franklin St.
St. Louis, Mo.—Mike A. Boyle, 1112-18 Hamilton Ave.
San Francisco, Cal.—Earl H. Jones & Co., 1150 Folsom St.
Seattle, Wash.—Earl H. Jones & Co., 819 Thomas St.
TOP QUALITY Since 1918
WHEELING MACHINE PRODUCTS COMPANY
WHEELING, WEST VIRGINIA
Factories at WHEELING, W. VA. and WOODLAKE, CALIFORNIA

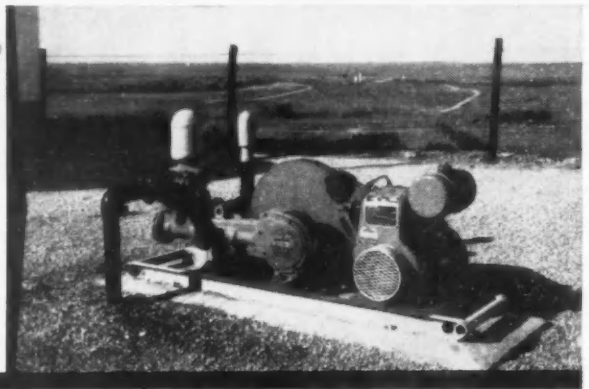


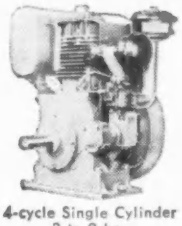
Rentals Firm Headquarters in Houston

The new main office and yard of Associated Oil Field Rentals, renters of pipe and equipment to the oil and gas industry, is located at 3701 Holmes Road in the industrial southeast section of Houston. The firm, a subsidiary of Associated Oil & Gas Company, specializes in providing the most modern equipment from a large and complete stock. Ten other yards are located in the Southwest to render a fast, efficient service.

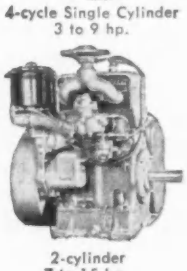
Efficient, Self-Sufficient

WISCONSIN-POWERED Pumping Unit on Duty in Cattle Country

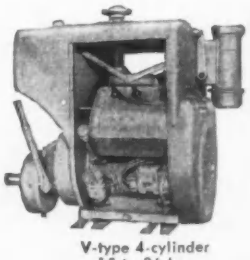




4-cycle Single Cylinder
3 to 9 hp.



2-cylinder
7 to 15 hp.



V-type 4-cylinder
15 to 36 hp.

Here is a Wisconsin-Powered oil pumping unit that is as *efficient* as it is *neat*. A standard Model AKND single cylinder Wisconsin Heavy-Duty Air-Cooled Engine operates a Goulds Reciprocating pump, delivering dependable, all-weather service the year 'round.

This installation is typical of the extremely compact, self-sufficient, foolproof Wisconsin-powered pumping units extensively used in oil field service. The unit shown above is working in the rich, active Little Chief Field of Oklahoma, where new, prolific producers are being developed. This is primarily cattle country and it is hazardous to have surface waste oil accumulations, so all oil is treated and re-treated — and it is in connection with this operation that this rugged Wisconsin-powered pumping unit is used.

Wisconsin Air-Cooled Engines used in heavy-duty oil field service are equipped with Stellite Exhaust Valves and Valve Seat Inserts and positive type Valve Rotators, assuring long engine life and lowest cost maintenance. Let us tell you about many other special oil field features.

More oil field utility units are powered by Wisconsin Heavy-Duty Air-Cooled Engines than any other make within a 3 to 36 hp. range — dominant preference that is based on actual performance records. You can't do better than to specify "Wisconsin Power" for *your* oil field equipment.

WISCONSIN MOTOR
Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A 8320-½-I

Newport News Shipbuilding Gets Contract for Tanker

The Texas Company has signed a contract with the Newport News Shipbuilding and Dry Dock Company for the construction of Texaco's fifth high-speed "New York class" tanker.

The new tanker, to be built at Newport News, Va., will be of 18,500 deadweight tons carrying capacity. It will be capable of a sustained sea speed of 18 knots and is designed to serve in the coastwise trade transporting bulk refined petroleum products.

The new vessel will be 565 feet long, will have a beam of 75 feet, and a summer draft of 31 feet. Its capacity will be in excess of 153,000 barrels. Delivery is scheduled for mid-summer, 1956.

Baroid's First Retail Mud Store Opened in Southern California

A store devoted entirely to the sale of mud was opened April 1 in Long Beach, Calif., when the Baroid division of National Lead Company opened its first direct sales store to serve the oil industry. The firm supplies clays, chemicals and other materials used in special muds needed for oil well drilling. Immediate service is available on a 24-hour basis, using Baroid's delivery facilities. Trained mud engineers are available for field service.

Locomotive Firm Changes Name To Alco Products, Incorporated

Shareholders of American Locomotive Company have approved a change in the name of the concern to Alco Products, Incorporated. The new name has been adopted to reflect the company's increasingly diversified operations which have grown beyond its role as locomotive supplier.

Three directors elected to the Alco board are George W. H. Allen, vice president of Enos and Sanderson Company, Inc.; Dr. Ernest W. Reid, president of Corn Products Refining Company; and Kenneth F. MacLellan, president of United Biscuit Company of America.

Clark Equipment Company Opens Automotive Products Office

Clark Equipment Company's Automotive division has established a field office in Tulsa to provide sales, parts and service facilities for the company's line of axles, transmissions, torque converters and complete power train packages.

Wade A. Eskridge has been appointed manager of the new office. The territory he will service includes Oklahoma, Texas, Kansas, Colorado, Missouri, Arkansas, Louisiana and part of New Mexico and Tennessee.

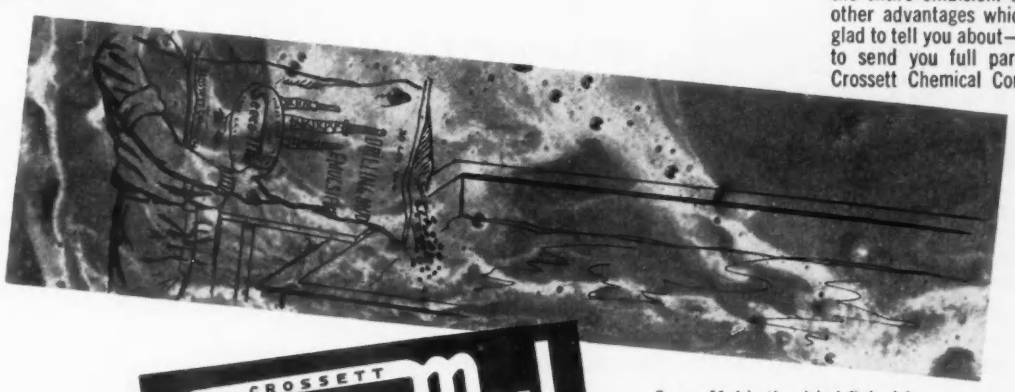
New Paxman Diesel Engines Shown in London Exhibition

Davey, Paxman & Co. Ltd. of Colchester and Ruston & Hornsby Ltd. of Lincoln used a unique 10-day Mobile Exhibition recently to introduce and demonstrate to oil industry people in the London area the new line of Paxman diesel engines. The demonstration included Paxman engines of 4, 6, 8, 12 and 16 cylinders in power ranges from 130 to 830 brake horsepower, all featuring their standardized seven-inch bore, Vee-type construction with interchangeable cylinder, piston and component assemblies. Served by a worldwide organization, Paxman engines are used for oil well drilling, pipe line, marine and other industrial applications.

Increase Drilling Rate With Less Drill Stem Torque

Better Lubrication • Lower Pump Pressure

Seeco-Mul effectively disperses the oil in emulsion muds which affords better lubricating qualities in the mud and allows faster drilling, reduces frictional drag of the drill string, and provides a higher velocity of the fluid on bottom. With good lubricating qualities in the mud, less drill stem torque is required, pump pressures can be lowered and more evenly sustained, and the bit stays cleaner. All of this means longer service life, too, for liners, collars, tool joints, bits, and drill pipe. Seeco-Mul is completely soluble in water and readily emulsifies Diesel or crude oils for use in sodium type or limed muds; in most cases Seeco-Mul efficiently tightens the entire emulsion. Seeco-Mul has a number of other advantages which your mud dealer will be glad to tell you about—or write to us; we'll be glad to send you full particulars without obligation. Crossett Chemical Company, Crossett, Arkansas.



CROSSETT

Seeco-Mul

DRILLING MUD EMULSIFIER

Seeco-Mul is the dried flaked form of so-called "crude floating soap," a compound of the sodium salts of abietic, linoleic, and oleic acids, together with quantities of wood tannins and lignins. Your own mud engineer can use Seeco-Mul without special instructions or equipment.

"MAKES A GOOD MUD BETTER"

for HIGH pump pressures

AMERICAN IRON

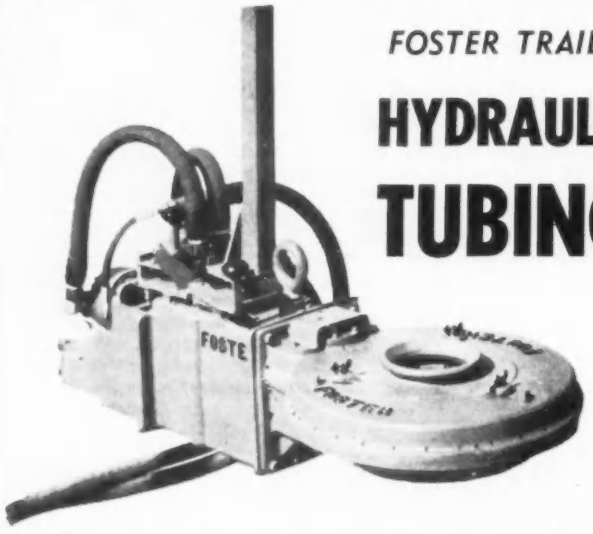
Hydra-Cushion

SLUSH PUMP VALVES & SEATS

AMERICAN IRON & MACHINE WORKS CO. · MANUFACTURERS OF OILFIELD EQUIPMENT · A · OKLAHOMA CITY U.S.A. · PESA

FOSTER TRAILER MOUNTED

HYDRAULIC
TUBING TONG



7 Seconds to break out joint

●

5 seconds to make up joint

The Foster Tubing Tong stays on the string the entire trip, eliminating all lost time in putting tongs on the pipe and removing them. The tong is counter-balanced and moved up and down with practically no effort, for access to the joints. Rugged, simplified construction assures you years of trouble-free service. Write for 4-page brochure.

SOLD AND SERVICED BY ALL FOSTER CATHEAD REPRESENTATIVES

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A DIRECT LINE TO OIL LOANS
from a bank that is...
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• Interested in making loans
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We sincerely solicit your banking business.
"Built on Service to the West"
The DENVER National Bank
CORNER 17TH & CHAMPA STS. AComa 2-2661
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Andy Shaw

John B. Humphrey

Black, Sivalls & Bryson, Inc. Open Sherman, Texas, Branch

Black, Sivalls & Bryson, Inc. announces the opening of a new branch at Sherman, Texas, to serve increased activity in that area. The new branch will carry a complete line of standard equipment used in that area and maintain an experienced tank erection crew. Andy Shaw, who has served as branch manager at Oklahoma City for four years, has been transferred to Sherman to take charge of the new branch, located on U. S. Highway 75 North. Shaw has had nine years' sales and service experience with BS&B at various Mid-Continent locations. John B. Humphrey, Jr., salesman at Borger, Texas, has been promoted to branch manager at Oklahoma City, succeeding Shaw. Prior to his Oklahoma City appointment, Humphrey served as sales and serviceman at Seminole and Drumright, Okla., as well as at Borger.

The Sherman Branch will be under the supervision of Ralph W. Nichols, Oilfield district manager at Fort Worth.

Timken Company to Build Rock Bit Plant in Canada

The Timken Roller Bearing Company has announced plans to construct a rock bit producing facility at its St. Thomas, Ontario plant. Construction will start immediately. The new building addition will contain 5600 square feet of floor space. Cost of building and equipment is estimated at $250,000.

Carbide insert rock bits will be produced at the plant in sizes up to three inches in diameter. The St. Thomas rock bit plant will be a finishing operation with the forgings supplied from the Wooster Steel Mill.

Mid-Continent Supply Named Lone Star Steel Distributor

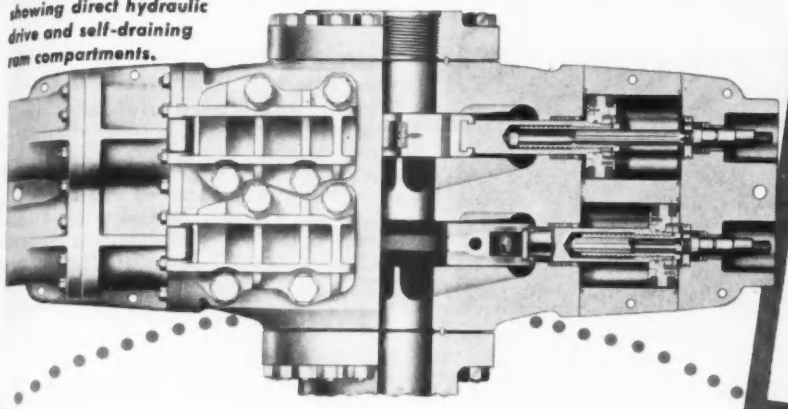
The appointment of Mid-Continent Supply Company as distributor for Lone Star Steel Company oil country tubular goods has been announced. Lone Star owns and operates a completely integrated steel mill in northeast Texas. The company also has a foundry which produces cast iron pressure pipe.

Chain Belt Buys Acreage To Expand Plant Facilities

CHAIN Belt Company announces the purchase of 47 acres near Downers Grove, Ill., for the purpose of expanding its Shafer Bearing division manufacturing facilities. Acquisition of this new property will enable the division to increase manufacturing capacity and improve service to both domestic and foreign customers.

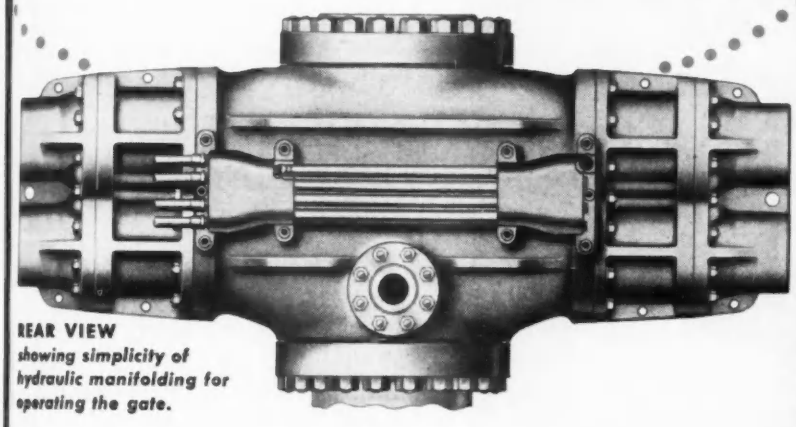
The Shafer Bearing division, now located at 801 Burlington Avenue, Downers Grove, was acquired by CHAIN Belt in 1953.

CUTAWAY VIEW
showing direct hydraulic drive and self-draining ram compartments.



Feature by Feature

they all add up to SHAFFER!



REAR VIEW
showing simplicity of hydraulic manifolding for operating the gate.

What do *you* value most in cellar control gate equipment? . . . Compactness? . . . Convenience? . . . Simplicity? . . . Safety? . . . Versatility? In Shaffer Hydraulic Cellar Control Gates you get all these—and more—to a degree unsurpassed by any other equipment. Compare—point by point, feature by feature—the *extra* values you get in Shaffer equipment, and you'll know why they are the choice of so many leading operators . . .

FIELD-PROVEN DEPENDABILITY

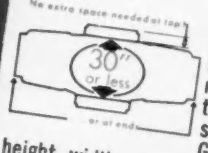
is probably the most important feature to look for in any pressure-protection equipment, and in Shaffer Hydraulic Gates you get safety backed by the organization that pioneered cellar control gates more than three decades ago. Successful from the first gate built, Shaffer Gates have nevertheless gone through a constant program of development to always keep ahead of the industry—and are today accepted as standard throughout the oil world.

SIDE DOOR RAM CHANGES

With Shaffer Hydraulic Gates there's no need to dismantle the gate each time the rams are changed. You simply open two doors in the side of the body, slide out the ram assembly, change rams, replace the assembly and bolt the doors shut. Closing the doors automatically aligns the rams within the body.

There's no need to allow extra room above the gate or at the ends to change rams—and complete ram changes can be made whether the pipe is **in** or **out** of the hole!

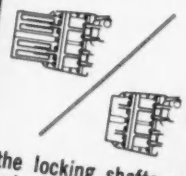
THREE-WAY COMPACTNESS



Space saved in the cellar is particularly valuable space. It means lower rig-up costs, smaller cellar requirements, simpler connections . . . and you save important space with Shaffer Hydraulic Gates. In all three dimensions—height, width and length—Shaffer Hydraulic Gates are unusually compact!

Even in sizes as large as 13⅜" (12" Series 900) Single Gates require only 18½" total height—Double Gates (two compartments in one body) only 30". There's no need for extra room above the Gates—nor need the compact length dimensions be expanded endwise—to permit ram changes.

RISING or NON-RISING SHAFTS



Whether you prefer the extra compactness of a non-rising shaft or the quick indication of ram position afforded by a rising shaft—you get the design **you** prefer from Shaffer. In both designs, built-in body extensions protect the locking shafts against damage in all positions—extended or retracted!

SELF-DRAINING COMPARTMENTS

No detrimental sand or mud accumulations can interfere with free ram travel when you use Shaffer Gates. Note how the rams travel on high guide ribs above the steeply-sloped gate bottoms which quickly drain mud and sand back into the well. Also, since well pressure is free to flow to the back of the rams, it actually assists in the closing and sealing action.

Get the full story

on these and many other Shaffer advantages before you invest in any pressure control equipment. And for those who prefer mechanical operation, Shaffer also provides a complete line of Double and Single Mechanical Cellar Control Gates with rams that are interchangeable, size for size, with those in Hydraulic Gates. This saves on inventory, simplifies maintenance where both types are used. See your nearest Shaffer representative for complete details—or write direct.

A copy of Shaffer's latest catalog will gladly be sent on request.

32 years of oil tool

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

Lane-Wells Votes to Join Dresser

Executives in attendance at the meeting during which Lane-Wells stockholders voted to become one of the Dresser Industries were, left to right, John J. Neale, president, Lane-Wells; Walter T. Wells, founder-chairman; Rodney S. Durkee, chairman of the board; H. N. Mallon, president, Dresser Industries; and J. B. O'Connor, executive vice president, Dresser Industries.

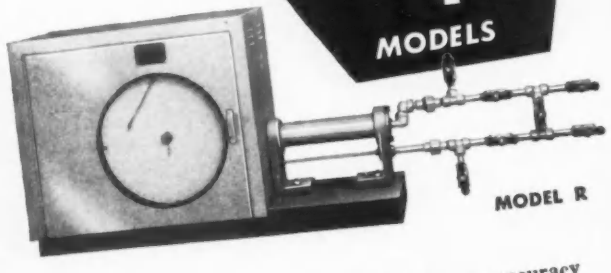
ARCCO

ARCCO-Anubis

LIQUID GRAVITOMETER

For PIPELINES, REFINERIES, GASOLINE PLANTS

NOW 19 MODELS



MODEL R

This ruggedly built instrument of laboratory accuracy is ideal for quick checking and for continuous recording of Specific Gravity of liquids under line pressure. Changes in Specific Gravity of sample are recorded with a very minimum of time lag. Foreign liquids and gases are automatically purged from sample. No moving joints or stuffing boxes to cause friction or leakage. Temperature corrected, this precision instrument is adaptable to high pressures. Hundreds are in daily use in plants and refineries of major companies. Available in 19 Models for Recording, Signalling, Transmitting and Controlling. Send for Bulletin 111R-3.

AMERICAN RECORDING CHART CO.

3113 E. 11th St. • Los Angeles 23, Calif.

AVAILABLE FOR EARLY DELIVERY

SEND FOR BULLETIN No. 111R-3

California Company Buys First United Aircraft Helicopters

Sikorsky Aircraft division of United Aircraft Corporation has announced delivery of two S-55 helicopters to The California Company who will use the rotary-wing aircraft on offshore oil operations in the Gulf of Mexico. The California Company is the first major oil company to purchase and operate S-55's. At present, the aircraft are being used in the Gulf on a lease basis by other major oil companies.

Schlumberger Announces Opening Of Three New Service Locations

Three service locations, two in Kansas and one in North Texas, have been opened by Schlumberger Well Surveying Corporation.

Offices were opened in Wakeeney, Kansas, March 1 with R. W. Clum as manager. He was formerly in the Phillipsburg, Kansas, office of Schlumberger which has been closed.

The other new Kansas location is at Medicine Lodge with Gayle T. Bradshaw as manager. He was previously manager at Russell, Kansas. F. M. O'Brien, field engineer at Wichita, Kansas, has been promoted to manager of the Russell location. ...The new service point in North Texas is located at Sherman, under the direction of R. S. Beaty.

Opening of Regional Office Announced by Cummins

Expansion of the Cummins regional organization has been announced by Cummins Engine Company, Inc., of Columbus, Ind., with the opening of the Piedmont regional office at Greensboro, N. C.

In charge of the Piedmont Region, which includes Virginia, West Virginia, North and South Carolina, is R. R. MacDonald. His headquarters in Greensboro will be at 601 North Elm Street.

R. R. MacDonald

MacDonald has been manager of the Cummins Diesel Sales Corporation branch at Milwaukee, and has spent four years in various capacities with the Cummins Diesel Sales Corporation branch at Memphis.

New Technical Service Group Formed by Dow Chemical

Two personnel appointments and the formation of a new section of Technical Service and Development have been announced by The Dow Chemical Company.

J. P. Murphy has been transferred from the Chicago sales office to the sales development unit of Technical Service and Development at Midland. In this assignment he will handle the sale of titanium.

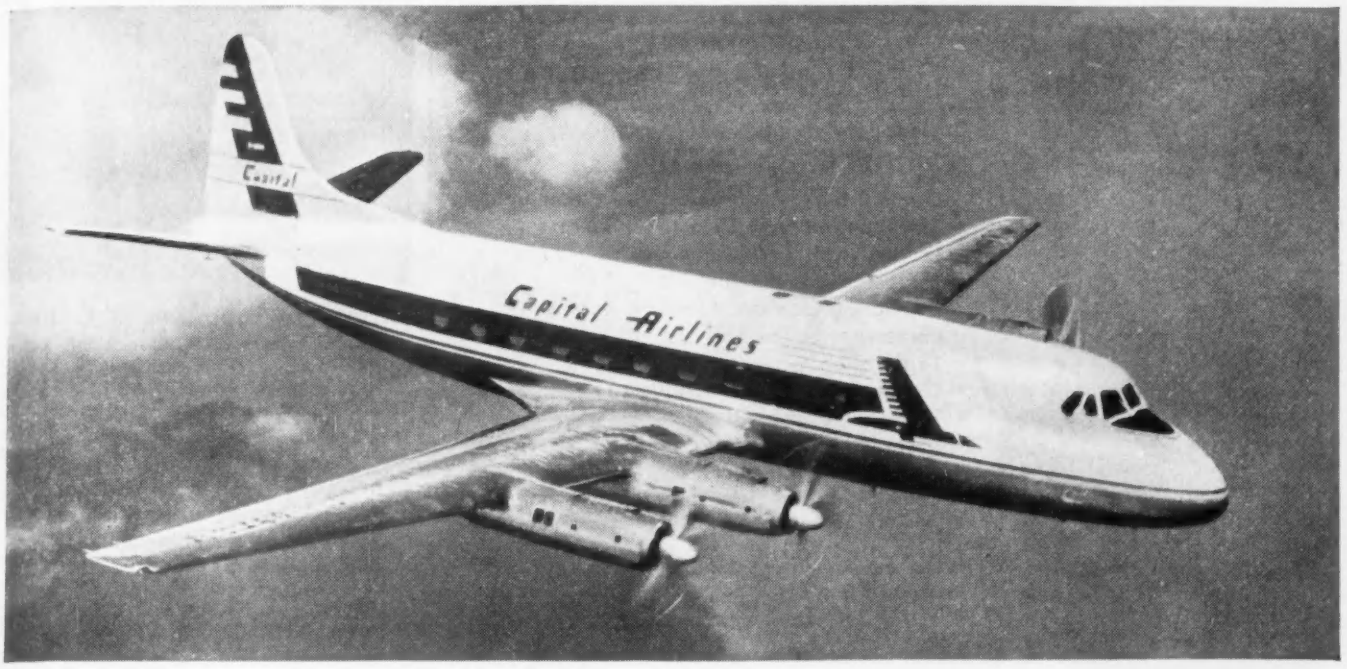
R. E. TenHoor has been appointed supervisor of the new section, designated the industrial chemicals section. This group will provide technical service for a number of organic and inorganic products.

Murphy joined Dow in 1942 and was employed in the Metallurgical Laboratory until 1950. At that time he transferred to sales and was assigned to the Chicago office.

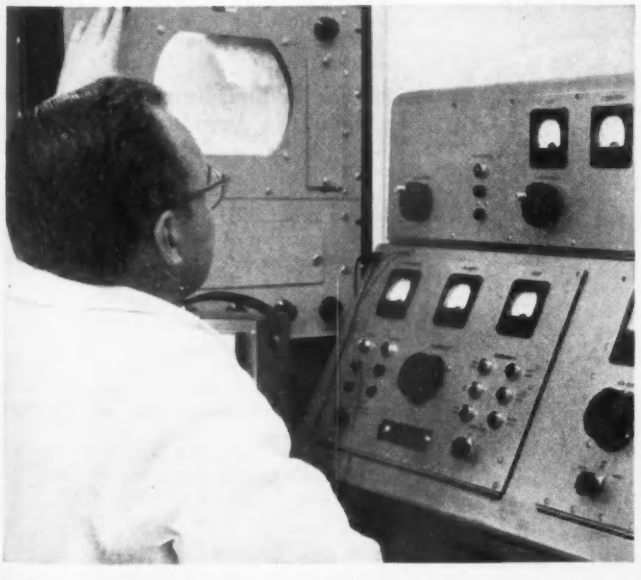
TenHoor joined Dow's organic chemical sales staff in 1950. He transferred to Technical Service and Development in 1953.

SHELL REPORTS

A PICTURE ROUNDUP OF SOME ACTIVITIES THAT MADE NEWS OUTSIDE THE PETROLEUM WORLD



A CAPITAL CONTRACT. To power its new turbo-prop Viscounts, Capital Airlines has selected Shell Oil Company as its supplier of fuel. Throughout flight history, as aeronautical engineers have built new engines and new planes, Shell research has developed the fuels to fly them. Shell Oil Company, leading supplier of aviation fuels to the United States commercial airlines, is helping turbo-prop travel become available for everybody.



ROCK AGER. What Mother Nature takes 10 million years to accomplish, Shell's atom smasher completes in one week. Behind thick walls, particles of rock are bombarded with radiation and thus aged by the first 2-million-volt Van De Graff accelerator in the petroleum industry. In this way, members of Shell's Exploration and Production Research Division are learning more about the age of rock and the origin of oil. Shell's advanced techniques in oil research are a strong investment in today to provide for tomorrow.

HITTING THE ROAD. It's the new method developed by Shell to measure the load-carrying capacity of asphalt. Electronic impulses simulate the jarring effects of traffic, and record the effects of continuous vehicular movement. Without damaging the highways, engineers get a long-range picture of how much a road can take. Shell's research is a step towards a better understanding of road requirements — and to more efficient, longer-lasting highways in the future.

SHELL

Geologists:

THE FIRST *CUSTOM*
GEONUCLEAR SHOP
TO SERVICE THE OIL INDUSTRY

UAC's New Atomic Showplace

offers you these advantages, all under one roof:

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Write or phone for free information and descriptive literature.

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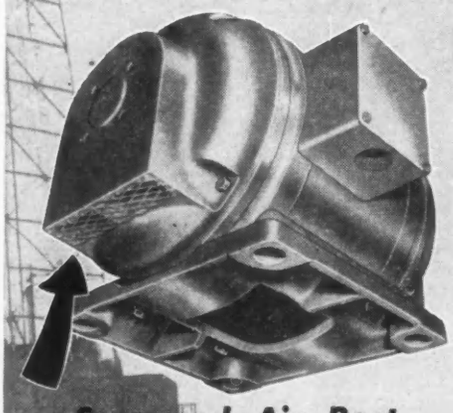
designed especially for *continuous* outdoor use . . .

FIELDMASTER
BALL BEARING
MOTORS

More and more FIELDMASTER Ball Bearing Motors are purchased for oil field use than ever before. Here's why: These **rugged** motors are **specially built** to meet the **tough** and **varied demands** of continuous outdoor use.

For example — heavy cast base assures alignment stability . . . heavy-duty, double-shielded, pre-lubricated bearings increase performance, reduce lubrication problems . . . high-grade silicon steel in the magnetic circuit reduces iron losses . . . wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems . . . high slip is available to take care of reciprocating load requirements encountered in pumping.

The FIELDMASTER has many other **outstanding advantages** that our distributor, the BETHLEHEM SUPPLY COMPANY, will be happy to show you. May we have them contact you . . . **without obligation?**



Screened Air Port Keeps Out Rodents!

VALLEY ELECTRIC CORP. 4221 FOREST PARK BLVD., ST. LOUIS, MO.
Distributor, BETHLEHEM SUPPLY CO., TULSA, OKLA.

Named to Roughnecks' Club

R. E. (Bob) Smith of Houston, right, was recently named chief of the Roughnecks' Club for 1955 in ceremonies held at Lone Star Steel Company's integrated steel mill in northeast Texas. E. B. Germany, Lone Star president, left, presented a plaque and jeweled lapel emblem to Smith.

Axelson Manufacturing Company Enters Milling Machine Field

The purchase of the Fray line of milling machines and milling attachments from the Fray Machine Tool Company, Burbank, Calif., is announced by the Axelson Manufacturing Company, Division of U. S. Industries, Inc. The milling machines will be manufactured in the same plant that has built the Axelson heavy duty lathes and special machine tools since 1915.

The machines are designed for use in all types of metal working plants. The milling attachments can be used on other machine tools and to build up special machine tools to perform a series of various machining operations.

Offshore Drilling Barge To be Built by Avondale

The California Company of New Orleans has awarded a contract to the Avondale Marine Ways, Inc. to construct a large portable offshore drilling barge. The designers of the unit are Friede and Goldman, Inc., naval architects and marine engineers.

The unit will be of the elevated-deck, self stabilizing type, raised and lowered to the bottom by hydraulically actuated corner pontoons. The lower hull is of a new design developed by the designer which presents a sloped side in all directions when on the bottom.

The rig will be diesel-electric powered, capable of drilling to 16,000 feet and more. Completion is scheduled for fall of 1955.

Baker and Logan Elected To New Gulf Publishing Posts

Warren L. Baker, editorial director of WORLD OIL, and for many years secretary of The Gulf Publishing Company, was elected vice president of the company at a directors meeting in May. J. L. Logan, exploration editor of WORLD OIL, was elected secretary of The Gulf Publishing Company. Both men have been with the Gulf Publishing Company for more than 25 years. Other officers of the company were reelected. They are Ray L. Dudley, president; A. L. Burns, executive vice president; Tom W. Nelson, vice president.

"As the twig was bent"...

Some 35 years ago the Wilson Supply Company opened its doors to serve a growing Oil Industry.

Its most important asset was a desire and determination to give the Driller and Producer "what they wanted—when they wanted it," in supplies and equipment of proven quality.

That policy has been responsible for its continuous growth. Branch stores have been advantageously located to best serve the Oil & Gas Industry.

Today—the oil men in the field have come to know they can depend on Wilson Supply Company and its products.

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ACIDIZING INHIBITOR

provides positive protection for well tubing and acid storage equipment at high or low temperatures.

"Rodine" 203 is an organic inhibitor designed especially for acidizing.

It is neither destroyed nor precipitated by hydrogen sulfide. It does not stimulate localized pitting. It is readily soluble in water or acid.

Economical, effective, and easy to use, "Rodine" 203 provides maximum protection at minimum cost.

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Eliminate Costly PARAFFIN Removal Methods with . . .

BrakeSol

HOLDS PARAFFIN IN SUSPENSION

from FORMATION to REFINERY

BRAKESOL is ECONOMICAL, prevents or removes Paraffin from the tubing, flow lines, tank bottoms and pipe lines. Effective on both asphalt and mixed base paraffin.

BRAKESOL is SAFE, won't harm skin; fire hazard is minimized. Sold only through supply stores. Complete service supplied by our Sales Engineers. Contact your local supply store.

WRITE FOR FREE DESCRIPTIVE FOLDER

BRAKESOL, Inc.
P. O. Box 9506 Oklahoma City, Okla.

White Motor Company Acquires National Supply Division

The White Motor Company, producer of trucks and tractors, has formally acquired the Engine division of the National Supply Company in Springfield, Ohio. The transfer of property facilitates White's entrance in the Diesel engine industry through the modern facility known as the producer of Superior and Atlas engines.

W. F. Burrows

William F. Burrows has been appointed general manager of the newly-acquired division, to be known as the White Diesel Engine division. William H. Johnson has been named division controller, and R. E. Laverty has been appointed to assist in the formulation of policies and procedures. Burrows has been in charge of Diesel engine development for White.

The White Diesel Engine division sales force will operate from the Springfield, Ohio, plant, and supervision and operation of other departments will be centered there.

Dowell to Double Size Of Research Laboratory

Dowell Incorporated is doubling the size of its research laboratory which is located at 11150 North Utica Avenue, Tulsa. An additional 1450 square feet of floor space in the company's equipment assembly building also will be acquired for studying chemical batching and mixing of field-size volumes of material.

The present laboratory is less than two years old but the company's growth during the last few years and the expansion into new oil field and industrial services has made more room necessary for research and technical activities.

Kaiser Corporation to Buy Basalt Steel Division

Kaiser Steel Corporation will purchase the Steel division of Basalt Rock Company, Inc., pipe fabricator. The multi-million dollar transaction is subject to the approval of stockholders of Basalt.

Facilities consist of two modern plants, one at Napa, Calif., near San Francisco, and the other at Fontana, near Los Angeles. Employing 800 people, the plants produce large diameter expanded steel line pipe, medium diameter electric resistance weld pipe, large diameter steel reinforced concrete pipe and a variety of fabricated steel products.

Other operations of Basalt Rock Company, primarily in the fields of concrete aggregates, Basalite and related building materials, are not affected by the purchase.

Cabot Shops, Inc. Purchases Franks Manufacturing Firm

The Franks Manufacturing Corporation of Tulsa has been sold to Cabot Shops, Inc., of Pampa, Texas.

R. A. Baker of Cabot will become president of Franks, in addition to his present position as vice president and general manager of Cabot Shops. It is expected that members of the present executive, engineering and sales departments will remain with the company, as well as all plant, field and office personnel.

PRECISION TUNGSTEN CARBIDE CASTINGS

- highest wear resistance
- highest precision
- lowest machining costs

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POSITIONS WANTED

SAFETY DIRECTOR—16 years' experience in industrial accident prevention, petroleum industry, including exploration, drilling, production, refining, natural gas transmission and petrochemical manufacturing. Fully qualified in fire protection engineering and industrial training. Excellent references and achievement record. Presently on foreign assignment. Desire to relocate in U. S. Member American Society Safety Engineers. Age 35. Available August 1. Box 62-W, c/o World Oil, Houston, Texas.

MISCELLANEOUS

•Printed forms for Office and Field—these stock forms are now used by oil companies, contractors and independent operators throughout the oil industry. Printed in large quantities—available for immediate shipment in any desired quantity when, where, as needed. Faster delivery and more economical. Write for free copy of "Oil Company Stock Forms" catalog giving illustrations and prices on more than 50 different available forms. Stock Form Dept., Gulf Publishing Company, P. O. Box 2608, Houston, Texas.

•AVOID DRILLING DRY HOLES—CARRILLO'S scientific method for oil exploration is a direct technique that accurately locates oil deposits. Twenty years of experience and success. Carrillo's survey puts the drill on the oil. For service, write to CARRILLO, 1013 No. Main Street, Santa Ana, California.

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Our organization can obtain oil concessions, farmouts, join in the financing of oil developments, handle all Government, corporate, legal, fiscal, banking, accounting, labor, and all local matters relating to the oil industry.

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VEDADO, HAVANA, CUBA
Cable address: PETROLEROS, HAVANA

New Westinghouse Department To Make Torque Converters

The Schneider Manufacturing Corporation, wholly-owned subsidiary of the Westinghouse Electric Corporation, has been dissolved to form the hydraulic drives department of the Westinghouse gearing division. The Schneider Manufacturing Company was purchased by Westinghouse in October, 1954.

The hydraulic drives department will sell, engineer and manufacture hydraulic torque converters and associated brakes and transmissions. Headquarters of the department will remain at Muncie, Ind.

Three key appointments announced for the new department are S. M. Johns, sales manager; T. P. Dunkin, manager of manufacturing; and P. L. Fosburg, engineering manager.

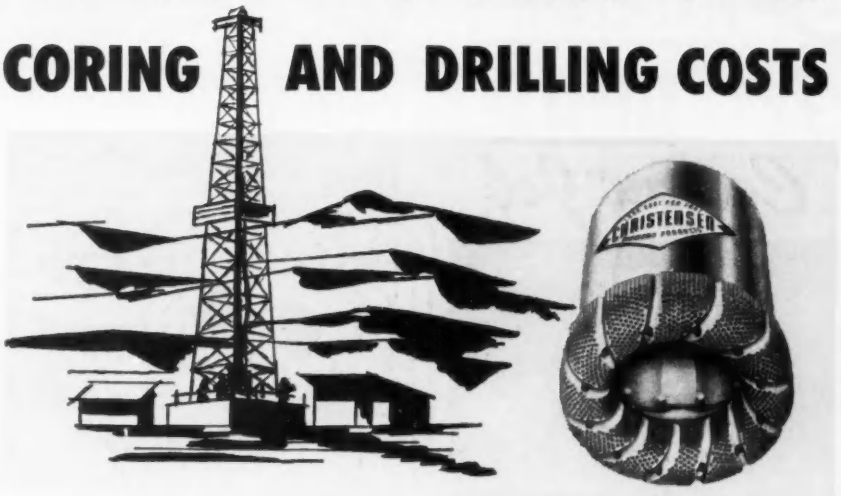
Caterpillar Establishes New Australian Subsidiary

Formation of Caterpillar of Australia Pty. Ltd., a wholly-owned subsidiary, has been announced by Caterpillar Tractor Company.

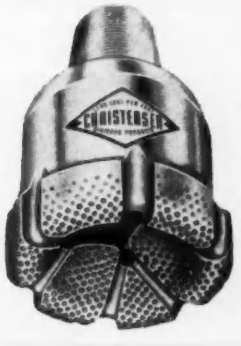
The subsidiary, third foreign company formed by Caterpillar since 1950, will manufacture and sell many of the regular products now built by the parent company, as well as replacement parts for the entire line of Caterpillar products.

Caterpillar has purchased 100 acres of land just outside of Melbourne and will start construction soon on a 100,000 square foot building.

DIAMONDS WILL REDUCE YOUR CORING AND DRILLING COSTS



No matter in what area your rig is operating . . . or in what formation . . . Christensen diamond bits will help you make hole for "Less Cost Per Foot." Check these four actual case histories . . . are your costs in line?



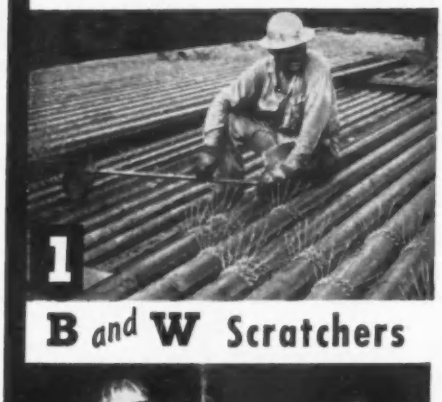
FORMATION BIT SIZE	TOTAL FOOTAGE	PENETRATION RATE	TOTAL COST	BIT COST PER FOOT	DRILLING CONDITIONS BIT LOAD POUNDS	RPM	FL. VOL.
BETHANY FIELD, PANOLA COUNTY, TEXAS							
Pettete and Travis Peak 6⅛"x3½" Core Bit	1000 ft.	4 ft./hr.	$1600.00	**$1.60**	6,000-12,000	60	200 gpm
WILDCAT FIELD, LINCOLN COUNTY, LOUISIANA							
Travis Peak 8⅝"x5¼" Core Bit	725 ft.	3 ft./hr.	$2145.30	**$2.96**	8,000-16,000	50-60	275 gpm
QUALEY DOME FIELD, ALBANY COUNTY, WYOMING							
Red Beds 6-3/16" Drilling Bit	638 ft.	2 to 3 ft./hr.	$ 846.05	**$1.33**	5,000-12,000	70	230 gpm
WERTZ FIELD, CARBON COUNTY, WYOMING							
Tensleep 8⅞" Drilling Bit	408 ft.	1½ ft./hr.	$2187.11	**$5.34**	12,000	60	250 gpm

Why not call the Christensen office nearest your location for recommendations for the drilling or coring problems you are encountering.

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

3 REQUIREMENTS
For a GOOD
Cement Job



1
B and W Scratchers

2
B and W LATCH-ON CENTRALIZERS

3
MOVEMENT OF CASING *

*The highest percentage of successful cement jobs result from . . . mud removal and prevention of channelling by . . . movement of the casing, from the time casing reaches bottom until the plug "bumps."

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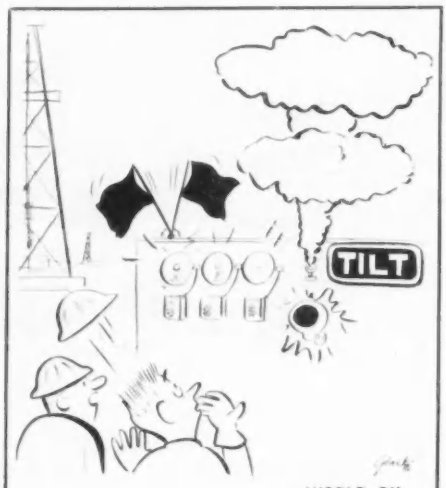
SQUEAKS from the BULLWHEEL



WORLD OIL

"No mistaking the trouble signals on this rig . . ."

What Else?

Mrs (sternly to husband arriving at 3): "What does the clock say?"

"It shay 'tick-tock,' an' the li'l doggies shay 'bow-wow' an' the li'l pshy-cat shay 'meow-meow.' "

Greetings

Policeman: "Hey you, didn't you hear me say 'Pull over'?"

Driver: "Oh, I thought you said, 'Good morning, Mayor!' "

Policeman: "It is a nice morning, isn't it.

Joker

A not-too-successful author went into a bookstore and asked a clerk, "How are my novels going?"

"I can't imagine, sir," came the reply, "unless it's shoplifters."

Lost and Found

A baseball fan was doing his best to cheer his favorite team on to victory, when suddenly he became silent and whispered to his neighbor, "I've lost my voice."

"You'll find it in my left ear, buddy," the neighbor replied sharply.

Stranger

The Sunday school teacher was reviewing a lesson. "Who led the children of Israel out of Egypt?"

No answer. So she pointed to a little boy at the back of the room and asked him. "It wasn't me," he said timidly, "we just moved here last week from Missouri."

Details

Woman driver to friend: "The part I don't like about parking is that noisy crash."

You Asked for It

Employer: "Whenever I enter the workshop I want to see every man cheerfully performing his task. Therefore, I invite you to place in this box any further suggestions as to how this can be brought about."

When the box was opened the next week it contained one slip of paper on which was written: "Don't wear rubber soles."

KEEP PURE DRINKING WATER ALWAYS HANDY

insist on the highest quality

Gotkool
water cans and coolers

Specify **"GOTKOOL"** the next time you order water cans or coolers. **"GOTKOOL'S"** exclusive construction keeps water cooler . . . fresher . . . purer. Extra wide, snug-fitting, splash-proof top keeps out impurities. Non-leaking, push-button faucets, either extended or recessed flush mounted. *Buy* **"GOTKOOL"** *at your supply store today.*

GOTKOOL Water Cooler — made in 2, 3, 5, 8, 10, 15, and 20-gallon sizes with extended or recessed flush-mounted faucet optional. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

GOTKOOL Water Can — made in 1½, 2, 3, 5, 10, and 20-gallon sizes without faucets. Extended or recessed flush-mounted faucets available at slight additional cost. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

Insist on the genuine — look for the *Blue and Black Label* with the name "GOTKOOL" in Red.

H. P. GOTT MFG. COMPANY
WINFIELD, KANSAS

Over 50 *Locations in the United States and Canada*

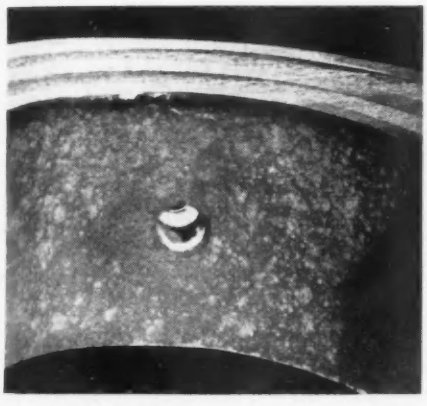
McCullough® REPORTS TO THE OIL INDUSTRY

Service *Anywhere Anytime*

New Services • • • New Tools • • • New Methods • • • Outstanding Results

New Burrless Cap for Ogival Bullet Provides Burr-Free Penetration

The new Burrless Bullet Cap is an exclusive McCullough feature. Inserted over the point of the improved ogival bullet at the time the perforator is loaded, it provides a completely burr-free hole on the inside surface of the perforated casing. Depth of penetration is not affected. Burr-free holes reduce the need for subsequent scraping and insure free passage of swabs, packers or other close fitting tools.



Unretouched photo above shows three string penetration by ½" Ogival Bullet with exclusive McCullough Burrless Bullet Cap. Note smooth, burr-free inner surface of pipe.

New Bulletin Available on M-3 Guns

This four-page, illustrated bulletin, No. 203, describes recent improvements in M-3 Bullet Perforator design and introduces the new, deeper penetrating Ogival Bullets. It gives specific examples of increased firing power and deeper penetration as experienced in competitive tests. Advantages, general characteristics, sizes, etc. are also given.

Request Bulletin No. 203 from McCullough Tool Company, 5820 South Alameda Street, Los Angeles 58, California.

Deeper Penetration Increases Production 2700 B/D

McCullough M-3 Bullet Guns Perforate 411 Feet of Pay Zone to Increase Production 245%

Excellent results obtained by the improved M-3 Bullet Perforator were dramatically illustrated by a recent field report from McCullough's Bakersfield Branch area.

M-3 Guns firing improved Ogival Bullets perforated 411 feet of oil zone for a 2700 B/D increase in production.

This well had previously been perforated by another service company for 1100 barrels per day. However, the operator believed better production was possible and called McCullough to re-perforate.

McCullough Service Crew made 17 runs with 3½" O.D. double 20-shot M-3 Guns, 14 runs with 3½" O.D. double 10-shot M-3 Guns and 8 runs with 3½" O.D. M-3 Guns one shot every two feet—a total of 39 runs in 39½ hours rig time.

A total of 1,000 improved ½" Ogival Bullets were shot in 5" O.D. 15 lb. cemented casing between 10,565' and 10,976'. Production increased from 1100 to 3800 barrels per day—a 245% gain.

Results like this can only be obtained by deepest penetration—penetration that reaches far out into the pay zone; exposes more productive formation; gets more oil—the kind of penetration you get only from McCullough M-3 Bullet Perforators.

"hardest shooting bullet perforators in the world"

McCullough Opens Two New Branches In Mountain Area

McCullough Tool Company has just opened new service branches at Westhope, North Dakota and Grand Junction, Colorado.

Both branches are fully equipped to render all McCullough wire line and fishing tool services to the rapidly expanding oil industry of the Rocky Mountain area.

Experienced crews, dependable equipment and skilled service are available on a twenty four hour basis.

McCullough M-3 Outshoots Premium Bullet Guns

In a very recent series of competitive tests, set up and supervised by a major oil company, regular improved McCullough M-3 Bullet Perforators outshot the premium priced guns of two other service companies. Here are the results:

	Average Penetration into Special Targets
McCullough	5¼"
Company A	4 3/16"
Company B	4⅛"

McCullough® TOOL COMPANY

LOS ANGELES
HOUSTON
EDMONTON

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

SECONDARY RECOVERY
CABLE ENGINEERING
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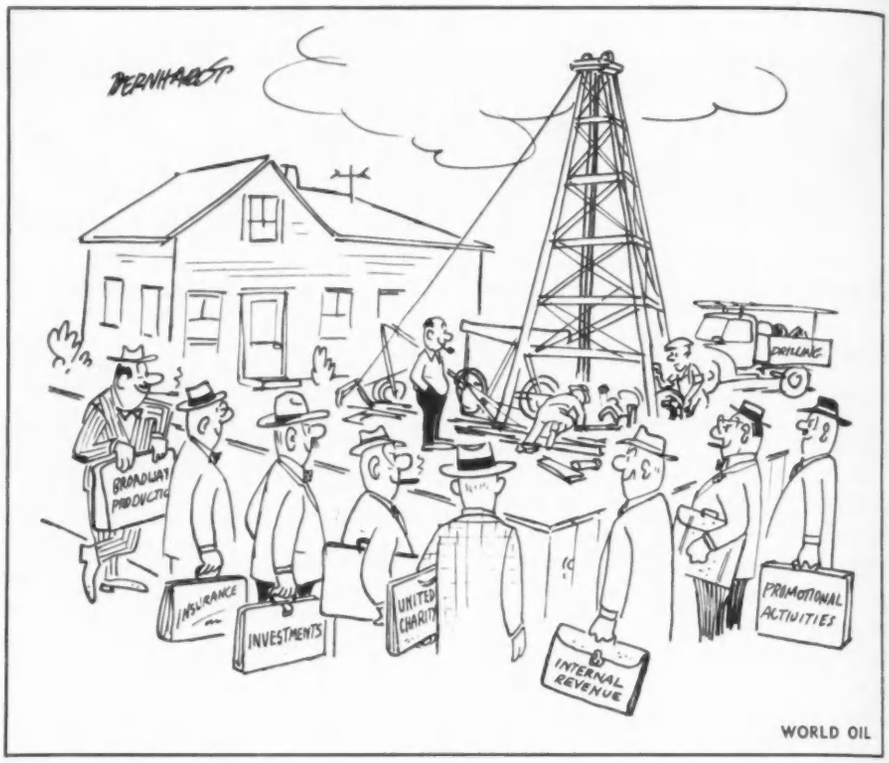
OIL FIELD SPECIALTY ITEMS



Never Satisfied

The driller was complaining about his wages:

"After you figure food, clothes and rent I have only $60 left for the necessities of life, and half the time they ain't hardly fit to drink."

Fed Up

Automobile trouble was the topic of the conversation.

"What model is your car?" asked one man.

"It's not a model," the other retorted. "It's a horrible example!"

An Eye for Business

Have you heard about the rich Texas oil man who visited Paris? He leaned 'way back to look up at the Eiffel Tower, and exclaimed: "Um-m-m . . . Ah wonder how many barrels that 'n produces!"

Crying Critic

The nickel-nursing Smiths took their infant son to a movie. The usher warned them that unless the child remained quiet, the management would refund the money and ask them to leave.

Near the end of the feature, Smith nudged his wife and whispered, "What do you think of it?"

"Terrible!" replied Mrs. Smith.

"Check," agreed Smith, "Pinch the baby."

Diagnosis

Woman: My husband keeps dreaming he's a refrigerator.

Psychiatrist: That's nothing; a lot of people dream they're something or other.

Woman: I know, but he sleeps with his mouth open and the little light shines in my eyes.

Kissin' Kin

It was rugged mountain country, and very large families were the custom. One day two old fellows met at the country store, and one said: "You chance to be a relative of Eph Hornbuckle over on Redbird Creek?"

"I been told we're distant kin," was the reply. "I'm the oldest young'un, Eph's the seventeenth."

Times Have Changed

"Good Heavens," said a guest at a party, "look at that long and lanky girl over there."

"Not so loud," whispered the host. "She used to be long and lanky, but she just inherited a million dollars. Now she's tall and stately."

Credit

Foreign woman customer (in bank): "I would lika to maka da loan."

Bank official: "You have to see the loan arranger."

Woman: "Who, plizz?"

Official: "The loan arranger."

Woman: "Oh, you mean da one who say 'Hi-Ho Silver?' "

Loud Celebration

A bishop and an admiral were pacing the floor in the hospital maternity wing. Finally the admiral learned he was the father of a nine pound son.

"Wonderful!" he roared. "As soon as I get back to the base, I'm going to fire a salute!"

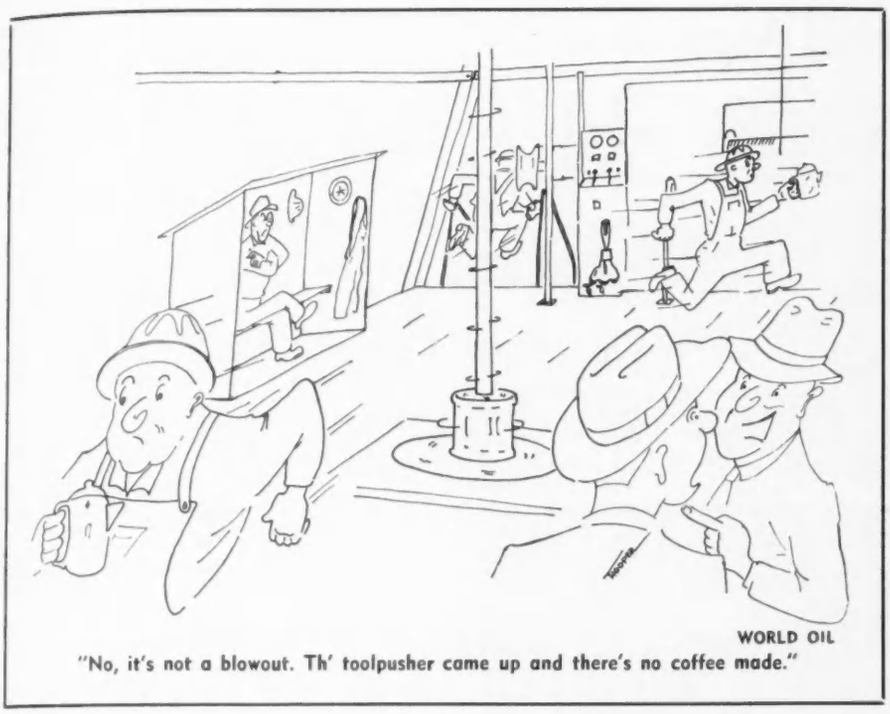
Shortly afterward the nurse informed the bishop he was the father of a fine red headed baby boy.

"Red headed!" roared the bishop. "As soon as I get back to my office I'm going to fire a Canon!"

Strange Clime

At the officers' club they were bidding farewell to one who was leaving for India. In the conversation a friend said: "It gets very hot in India at times. Aren't you afraid the climate might disagree with your wife?"

The man looked at him reproachfully. "It wouldn't dare."



WORLD OIL

"No, it's not a blowout. Th' toolpusher came up and there's no coffee made."

An Easier Way

Small girl, rebelliously practicing the piano: "And another way for me to be popular, Daddy, is for you to be rich."

Proud Parent

Friend: "What is your son going to be when he passes his final exam?"

Father: "An old man."

Mouthpiece

Then there was the lawyer who was retained by the farmer to prosecute the railway company for killing 24 hogs. He wanted to impress the jury with the magnitude of the injury.

"Twenty-four hogs, gentlemen! Twice the number that are in this jury box."

Backfired

Customer: "May I exchange this unbreakable doll?"

Clerk: "It there something wrong with it?"

Customer: "No, only the baby's broken every breakable thing in the house with it."

Busy

It was raining pitchforks as a motorist stepped into a small restaurant and sat down. As the waitress came for the order, he glanced out the window and remarked, "Gee, this looks like the big flood."

"The what?" asked the girl.

"The big flood. Haven't you read about the big flood and the ark landing at Mount Ararat?"

"Gee, mister," replied the waitress, "I ain't had time to look at a paper all week."

After Hours

The maintenance superintendent took his secretary out to dinner one evening and in the taxi on the way to the night club he squeezed her arm gently and said, "How about a little hug and a little kiss?"

She answered quite abruptly, "Look, we're supposed to be going out for some fun. Can't you forget the office?"

Logical

A mountaineer, on his first visit to a town of any size, came to the city with his son. He was fascinated by the asphalt streets. Scraping his feet on the hard surface, he remarked to the boy, "Well, I can't blame 'em for building a town here, ground's too darned hard to plow, anyhow."

Amateur

A visitor stopped in at a local club room to pass the time of day and noticed three men and a dog playing draw poker.

"Sure must be a smart dog," commented the stranger.

"Naw, he ain't very smart," piped up one of the trio. "Every time he gets a good hand he wags his tail."

Philosopher

"What's the death rate around here?" a tourist asked the old-timer.

"Same as it is back east, son," replied the old man. "One to a person."

I Ask You

The man dashed into his wife's bedroom absolutely red with anger. "Miserable one! I know everything!"

"Don't exaggerate so," she remarked calmly. "When was the battle of Waterloo?"

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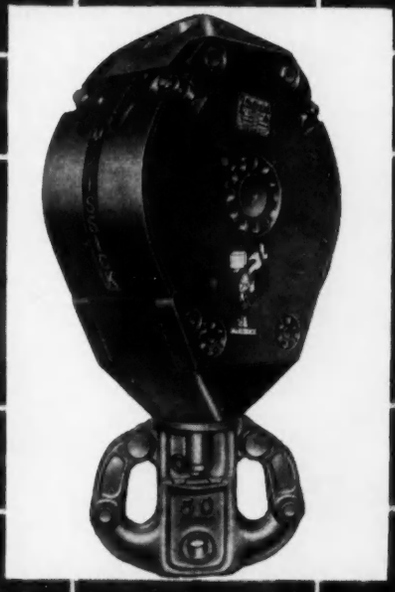
"Th' FACTS add up . . .
'tis a BETTER BLOCK."



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Box 2496 Tulsa, Oklahoma

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

New Books, Maps and Movies

GULF COAST MAPS, L. J. Wilson Map Company, P.O. Box 6277, Houston 6, Texas.

The following maps are now available from the L. J. Wilson Map Company:

Total Gulf Coast map with offshore blocks shown in the Gulf; hand-colored map which marks oil fields, gas fields and distillate production, omitting tabulated factual data.

Texas and Louisiana offshore lease maps; two maps made from the Federal lease plats joined together, showing leases, expiration dates and wells. Both Federal and state block numbers are shown in Louisiana where they conflict.

Products pipe line map of Harris County; outline map of the county which shows all principal product lines and principal refineries and plants along the ship channel. Price of this map is $25.

•

THE GEOLOGY OF TEXAS, VOLUME I, STRATIGRAPHY, Sellards, Adkins and Plummer, Bureau of Economic Geology, The University of Texas, Austin, Texas. $3.25.

The third printing of the University of Texas bulletin is now available. Originally published in 1932 and reprinted in 1947, this third edition consists of 54 text figures, ten heliotype plates and the geologic map of the state in color.

BRADEN WINCHES ARE:

★ **SAFE:** Up to 50% more reserve pulling and holding power than ratings indicate.

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BRADEN Winches

SAFETY AND THE DRILLER, American Association of Oilwell Drilling Contractors, 321 Reserve Loan Life Building, Dallas, Texas. $1.

In this booklet, which recognizes the driller as the key man on the derrick floor, emphasis is placed on the driller's position as a leader, and the continuous appeal is to remind him of his responsibility for "following through" as the real director of various drilling details. Most of the messages are aimed at the necessity for working safety. The driller is reminded that the most efficient method fits best with the safest method, and that adherence to best working conditions means as much to the drilling crews as to management. It is a handy study and reference for driller or contractor.

•

ANNUAL RESUME ROCKY MOUNTAIN OPERATIONS 1954, Petroleum Information, Continental Oil Building, Denver. $10.

This 25th annual resume of a year's activity reveals record-breaking refining, production, leasing, drilling and exploration work being carried on in the Rocky Mountain area. Combining maps, electric logs, statistical data and industry reviews for 1954, this book provides a complete reference of operations in the 11-state region.

•

GENERAL RULES AND REGULATIONS UNDER THE NATURAL GAS ACT, Federal Power Commission, 3728 Gilbert Drive, Shreveport, La.

A compact and accurate reference to the rules of the Federal Power Commission applicable to the Natural Gas Act is now available. The material in this new publication is a compilation of Subchapters A (General Rules) and E (Regulations Under the Natural Gas Act) of the rules and regulations issued by the Federal Power Commission as of January 1, 1955, and the Natural Gas Act. Subchapters F (Accounts) and G (Approved Forms) have been excluded. Information may be obtained from Robert M. Harris in Shreveport.

•

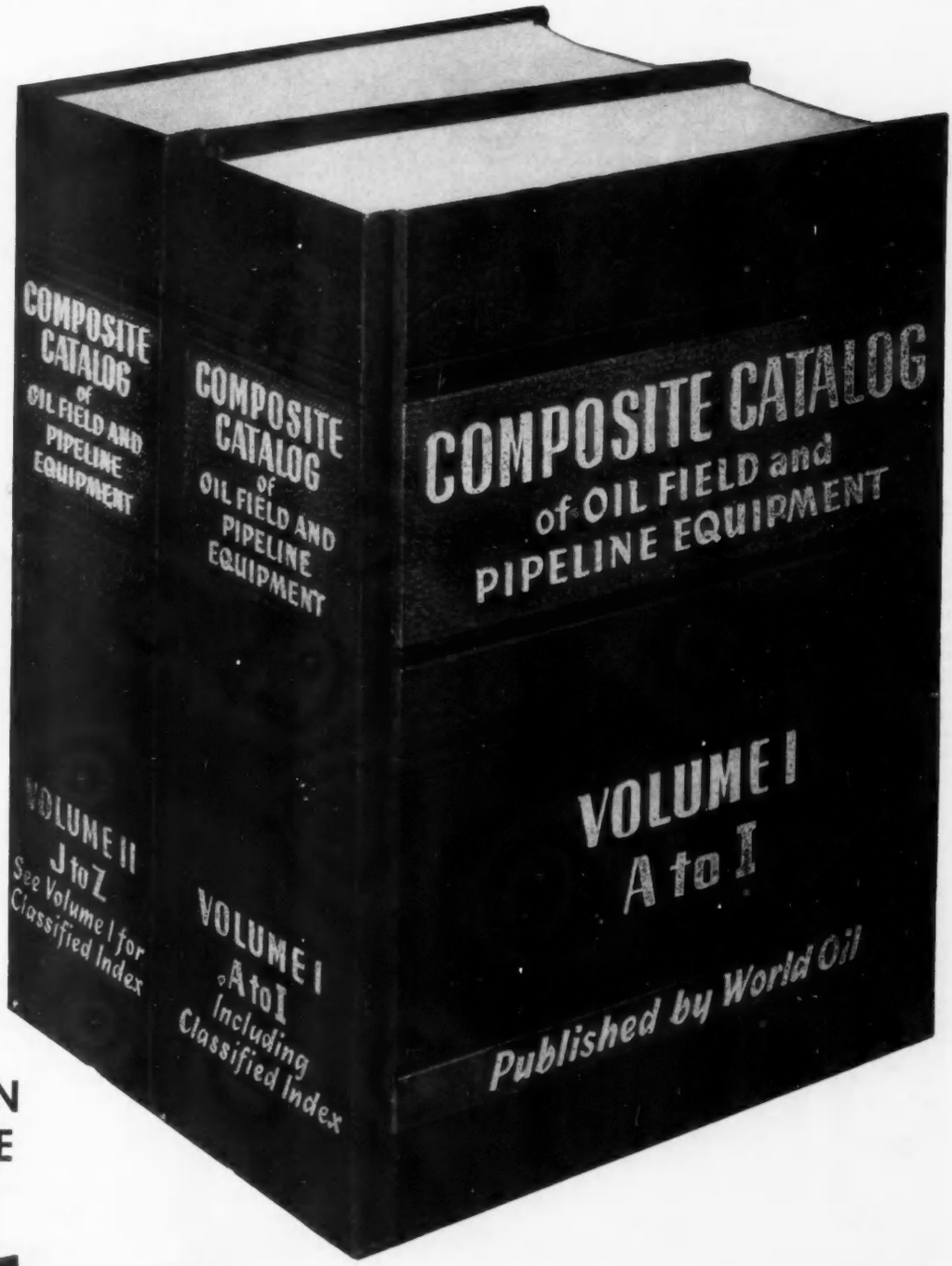
FIELD HANDLING OF NATURAL GAS, Petroleum Extension Service, The University of Texas Division of Extension, Austin.

A summary presentation of practices for field handling of natural gas, this manual has been prepared primarily to aid field men who daily deal with the problems of production and transportation. Well illustrated, the manual includes discussions on growth of the natural gas industry, conservation of natural gas, the natural gas operator, gas piping, valves and fittings, flow system equipment, control instruments, the prevention of hydrates, separation of gas and liquids, cold-separation units, preparing natural gas for market and orifice meters. Highly technical matters which would not contribute to the further education of those who have the problems first hand have been omitted. The information, collected from many sources, individuals and suppliers in the oil industry, was compiled under the guidance of a Special Formulating Committee appointed by the American Petroleum Institute, Division of Production.

Save TIME AND MONEY

When you need information about oil field equipment...

YOU WILL FIND IT QUICKER HERE


COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
COMPOSITE CATALOG of OIL FIELD and PIPELINE EQUIPMENT
VOLUME II J to Z See Volume I for Classified Index
VOLUME I A to I Including Classified Index
VOLUME I A to I
Published by World Oil

THAN HERE

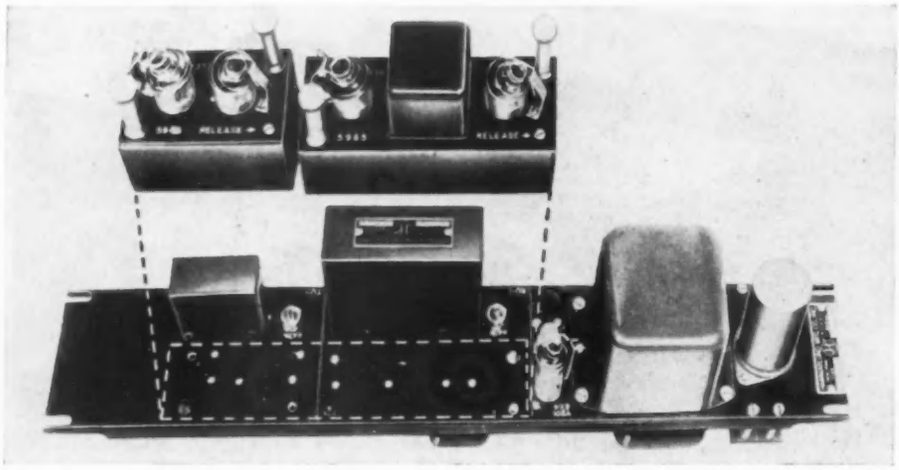
WHATEVER you plan to buy in the way of oil field or pipe line equipment or services, you're certain to find catalogued in the Composite Catalog. Hundreds of manufacturers have filed data on over 3,000 products in the current edition.

Remember, to save time and money at both ends of the line, look it up first in Composite Catalog!

COMPOSITE CATALOG

What's New In Equipment . . .

Drilling • Production • Exploration



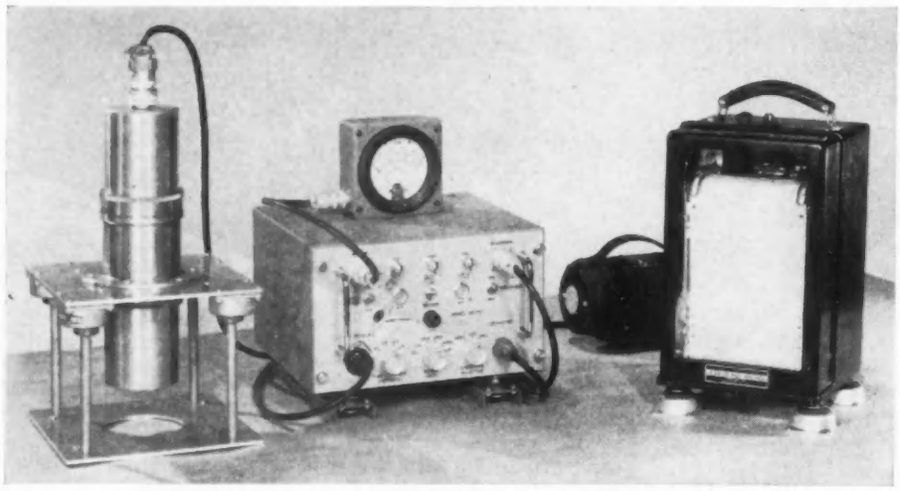
Signaling Units

Hammarlund Audio-Tone Signaling Units, used for transmitting and receiving signaling, dialing, telemetering, supervisory controls and other information, are now available in new modular design packages. The units are available in various combinations of transmitters and receivers including a duplex signaling unit, a dual transmitter unit, a dual receiver unit and individual receiver and transmitter units. Each makes use of plug-in audio tone generators and highly selective receivers.

Plug-in units are universal and completely interchangeable. Shown is the transmitter and receiving unit released from the chassis. The frequency determining element of the tone generator is a separately mounted small unit, as is the filter for each receiver.

Up to 48 on-off or raise-lower functions can be controlled over a single circuit with these devices, which operate in the range of 425 to 6025 cycles at intervals of 100 or 150 cycles.

For more data circle **No. E1** on Readers' Service Card, last page this issue.



Survey System

A new scintillation survey system for aerial and ground radioactivity exploration has been announced by Nuclear Instrument and Chemical Corporation. The complete DS-7 system consists of a scintillation detector with a 3-inch sodium iodide crystal, a ratemeter, chart recorder and buzzer alarm to alert pilot or observer. The system weighs less than 75 pounds, and features low power consumption (60 watts).

The system features a large crystal which produces more than 3 million counts per minute in a one milliroentgen per hour field. The sensitivity and efficiency of this instrument make it possible to distinguish small radioactivity differences while flying.

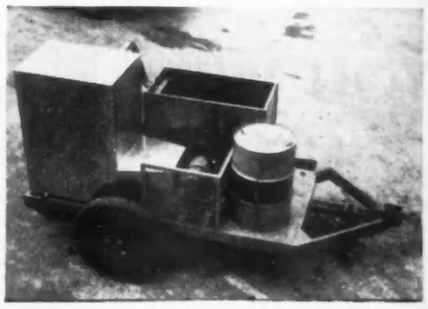
For more data circle **No. E2** on Readers' Service Card, last page this issue.

Aluminum Pipe

Race & Race, Inc., has developed a lightweight, sturdy aluminum pipe for use in petroleum and mining areas for temporary oil, water or gas lines. Heart of the new development is a special coupling, built to withstand high pressures of oil, water or gas, that is quick to assemble and dismantle, yet provides a non-leaking joint when coupled.

With the new system, savings are realized in rig time, transportation and handling of pipe, and laying and picking up lines. The aluminum lines can be installed in the field ten times faster than steel pipe, and with less manpower. As much as three miles of pipe can be handled easily on one truck.

For more data circle **No. E3** on Readers' Service Card, last page this issue.



Water Purifier

An unusual water purifier, developed by Rogers Geophysical Company for foreign field crews, can convert river, pond or salt water into drinkable water at the rate of 48 gallons per hour.

Box on the rear houses evaporating coils, which are heated by the diesel motor in the middle of the trailer. The motor, in turn, is fed from the fuel tank. After passing through the evaporating coils, the water passes through another set of coils to a collecting tank. Feed water is obtained through a hose at the back of the trailer. Automatic level controls keep the proper amount of water running through the purifier to maintain the 48 gallons per hour production.

For more data circle **No. E4** on Readers' Service Card, last page this issue.

Logging Instrument

Bird Well Surveys has developed a gamma ray logging instrument that can be run in the hole while attached directly to the jet perforating tool. This new instrument has undergone extensive testing and has proved to be able to withstand the full jet explosion in either wet or dry hole. The gamma ray head logs accurately through the pipe, enabling precise placement of the perforations in the pay formation. Thus, the two operations that ordinarily required using collar logs are combined in a single trip in the hole.

For more data circle **No. E5** on Readers' Service Card, last page this issue.

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"Here comes your QD Sheave — the original two-piece design."

TALK ABOUT

quick delivery . . .

. . . you haven't seen *anything* until you order a QD sheave or V-belt from your local Worthington distributor or supply store!

You'll get what you need — in exactly the right size — almost before you can say "Quick-Detachable"! (That means the Worthington sheave is easy to get on, easy to get off — but always tight on the shaft. It's the *original* two-piece sheave).

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As SIMPLE and Dependable as the Pull of a MAGNET!

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MAGNETROL

The Simplest, Most Versatile LIQUID LEVEL CONTROL *Ever Devised!*

Linked to liquid level by infallible magnetic force, Magnetrol is free from the limitations inherent in mechanical or electrical controls. With the actuating magnet rated at 98% of initial strength after 30 years, Magnetrol has *infinite operating life,* with practically no maintenance at all. There are no wearing parts to get out of order.

What's more, Magnetrol's simple operating principle permits easy, economical modification of standard units to meet *any* pressure, temperature or corrosion requirements. That's why there's practically no limit to Magnetrol's use. It's also why "specials" are likely to be standard with us. Magnetrol units control level changes from .0025-in. to 150-ft. —with single or multi-stage switching.

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Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

PUMP & BAILER SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.

Composite Catalog, Page 3433

Write for descriptive price list.

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CUT MUD CLEANING COST AND MUD WASTE with the LINDA "K"

Linda "K" Sample Catcher Is Fully Field Tested and Proven

Washed cuttings of the finest sand can be taken continuously, or at any desired interval by the new Linda "K" Sample Catcher. Fully field tested and proven, the Sample Catcher is now available for installation on Linda "K" Rotary Shale Extractors.

A removable Catcher screen is enclosed in the charged cylinder and is sprayed by jetted water from the inside wall of the charged cylinder, which prevents overflow of the screen and gives a true washed sample of the cuttings. Washing fluid can then be returned to mud system or waste pit.

SOLD THROUGH LEADING SUPPLY STORES
Write today for complete details.

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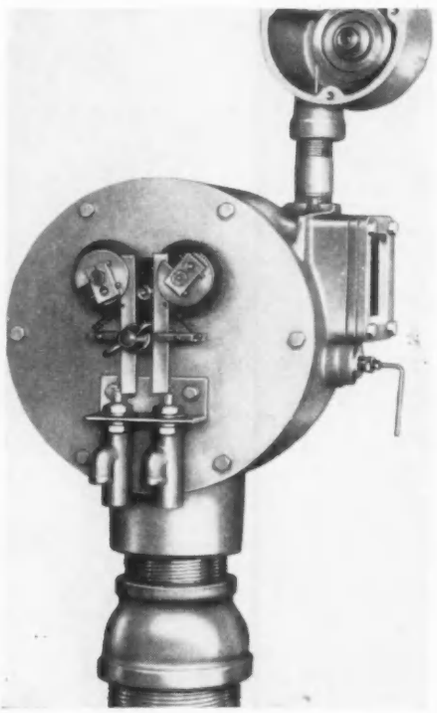
Offices and Plant: P. O. Box 1224
Alice, Texas, Phone 4-4901

PRODUCTION



Tank Level Control

A new level control for S&J automatic tank gages has been announced by Shand & Jurs Company. Designed to protect transfer and storage tanks and contents on leases, as well as bulk storage at refineries and terminals, this new level control can be used to operate supply line valves when tank contents reach critical high or low points. It can automatically prevent rupture or damage to tanks, loss of product, and danger to personnel and equipment.

This new level control for automatic tank gages incorporates pneumatic valves which operate on air or gas pressure up to 25 psi.

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Oil Well Heater

An 18-foot electric oil well heater, developed cooperatively by N. W. Curson Associates and the Industrial Heating department of the General Electric Company and built by the Castaic Oil Tool Corporation, can increase oil output 900 percent in low-producing wells. In practice, on wells which produce five barrels a day, production has been increased to as much as 45 barrels a day, the increased production a result of the faster rate of flow made possible by the heaters lowering the viscosity of heavy, sludgy crude oil in this type of well.

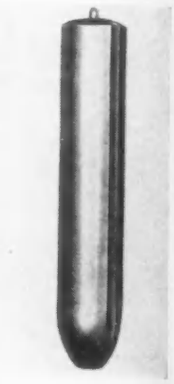
Constructed from six 80-inch heater units connected in pairs, the total rating of the complete heater is 460 volts, 15 kilowatts. The heaters are sealed in oil-tight pipes, and the connections are brought up through a rigid conduit.

For more data circle **No. E7** on Readers' Service Card, last page this issue.

Indicating Plug

The Cavins Company has announced development of a new bottom hole indicating plug. In use, it gives immediate and definite indication that well bottom has been reached and helps prevent any damage to well casing that might result from running the tools any longer than necessary.

Cast of a cement-like material, which is impregnated with a bright yellow pigment, making it easily distinguishable from the material being cleaned out, the plug will not leach or fade and will last for many clean-out jobs.



It may be either slipped into the first joint of a liner to be run into a new well, or, if it is to be installed in an old well, it may be attached to the bailer bottom with a strand of soft rope and whipped off near well bottom.

The plug is 24 inches long with water courses running up the side. Diameters run about ¼-inch under the I.D. of the pipe.

(This item supplements The Cavins Company data on Pages 1154-1159 of the Composite Catalog, 20th Edition.)

For more data circle **No. E8** on Readers' Service Card, last page this issue.

Completion Tool

The Model H parallel string completion nipple, latest addition to the line of subsurface flow control tools manufactured by Pressure Services, Inc., provides efficient flow passages for dually-completed wells. Installed in the tubing string immediately above a single packer installation and designed to accept the threads of both strings of a parallel-stringed well installation, it allows each zone to be produced separately through separate strings of tubing.

It also permits artificial lifting of the upper zone without producing the gas through the pump as the gas may be conducted up the tubing-casing annulus. When installed in a singly-completed well, one string may be used to inject chemical with mud in place in the annulus.

The Model H separation sleeve with a self-cleaning locking device may be run and pulled through an API pump seating nipple with wire line tools. When landed in the completion nipple, it seals off the interconnecting flow passages and separates the producing horizons of a dual.

By interchanging retrievable mandrels,

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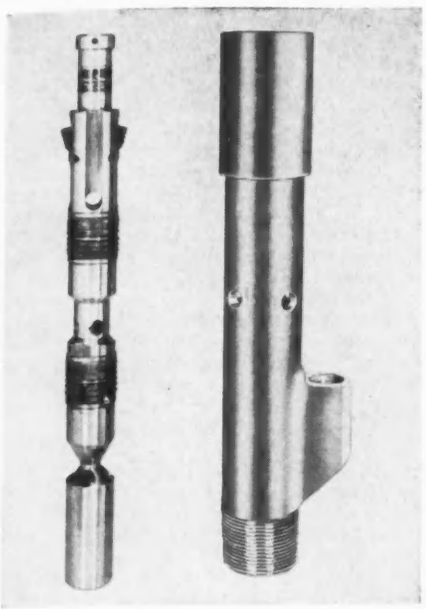
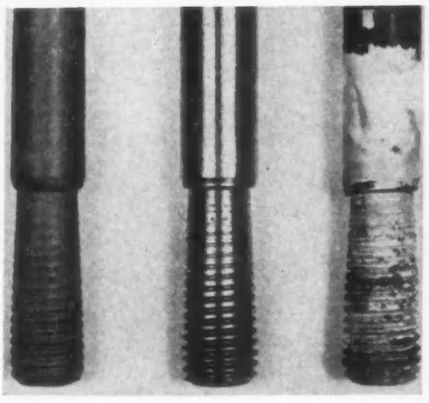


both strings may be plugged for running pipe into the well, either zone may be treated, tested or swabbed in through one string, the two strings may be circulated or the producing zones crossed over.
For more data circle **No. E9** on Readers' Service Card, last page this issue.



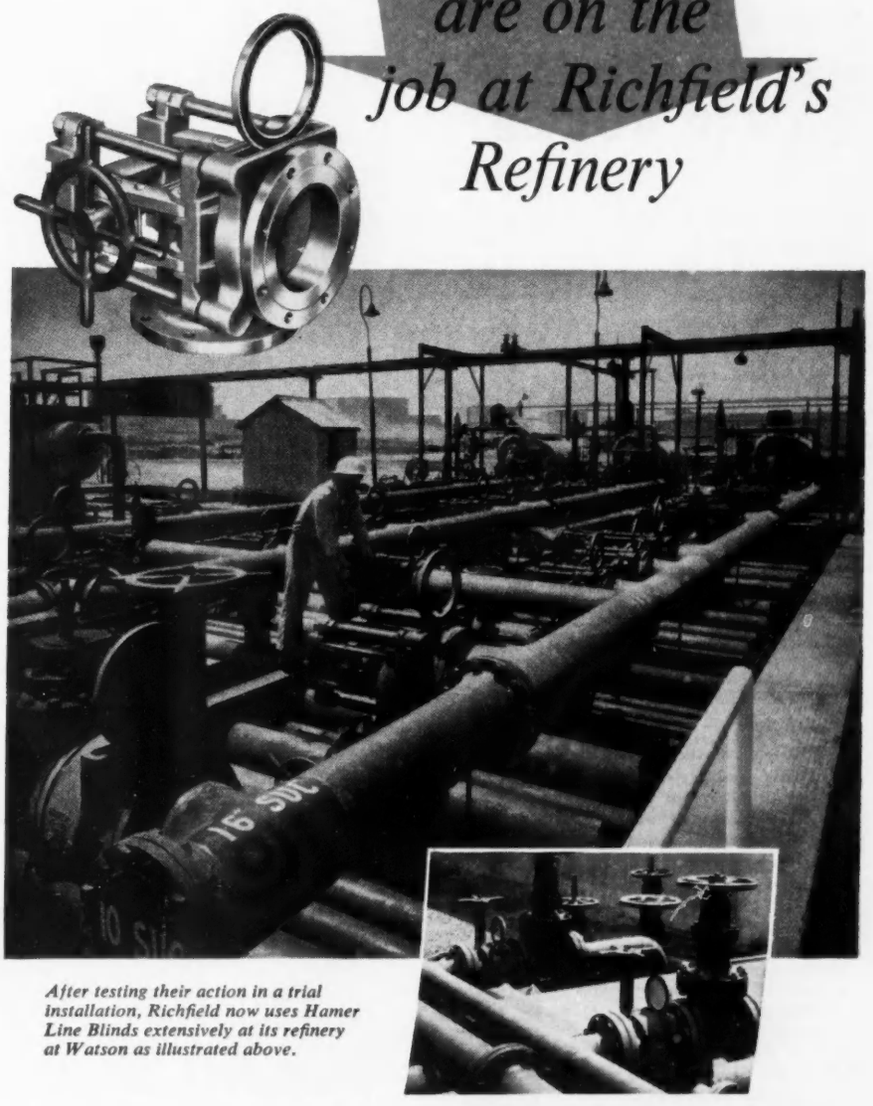
Vinyl Mastic Coating

A new vinyl mastic protective coating that requires only a one-coat application has been developed by Amercoat Corporation. It can be applied at a thickness of ten mils in one double-pass spray coat, and produces a heavy film thickness without sacrificing vinyl chemical and moisture resistance. The coating is applied with conventional industrial spray equipment. It also reduces the possibility of edge corrosion because its heavy, impervious film provides a corrosion resistant barrier around edges and sharp objects which always have been trouble spots in industrial maintenance painting.

New properties of the coating are the result of an increased vinyl resin content made possible by new combinations of solvents.

Above, bolt on left has one coat of primer and one coat of the No. 87 vinyl mastic. Center bolt is uncoated to show surface detail. Bolt on right has three coats of a good vinyl coating. Both coated bolts were exposed to severe salt spray test for the same period of time.
For more data circle **No. E10** on Readers' Service Card, last page this issue.

Impenetrable Sealing
HAMER BLINDS
are on the job at Richfield's Refinery



After testing their action in a trial installation, Richfield now uses Hamer Line Blinds extensively at its refinery at Watson as illustrated above.

HAMER *Visible Shut-off* LINE BLIND VALVES

HAMER *Plug Valves*

Thousands of users have proven the easy and immediate operation of Hamer Plug Valves. Will not stick or freeze.

Refinery operations require a valve that will provide a continual leakproof line shutoff. Hamer Blinds with their foolproof sealing action are unsurpassed for providing an absolute line seal that's both positive and permanent. In addition, Hamer Blinds fast, one minute, one man operation literally pay for their cost in downtime saving.

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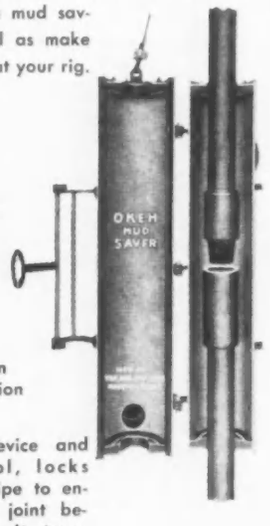
Okeh PRODUCTS

Save Money . . . Save Costly Mud . . . Save Lost Time and Labor of Expensive Accidents! Use the OKEH MUD SAVER BUCKET

Wherever there's drilling — mud on the derrick floor can cause costly accidents . . . and mud wasted is money gone!

The famous Okeh Mud Saver Bucket can save its cost in mud savings — as well as make for safety first at your rig.

$240.00 Complete Delivered

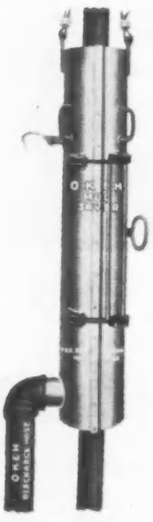


Open Position

The simple device and economy tool, locks around drill pipe to enclose the tool joint before breakout. It traps and returns the drilling mud efficiently through a swivelled discharge hose —right to the mud ditch. Side and end sealing members are replaceable and at $18 per set adapt the Bucket to fit any size drill pipe. Simple to operate — it saves its cost time and again.

The Okeh Mud Bucket is YOUR SURE PROTECTION against slippery and dangerous derrick floors. Safety engineers, your rig workers, all praise it. Okeh Mud Buckets are precision made — 10" metal body — 6 ft. long, equipped with 5" discharge hose. Available through your supply store.

*Specify drill stem size.

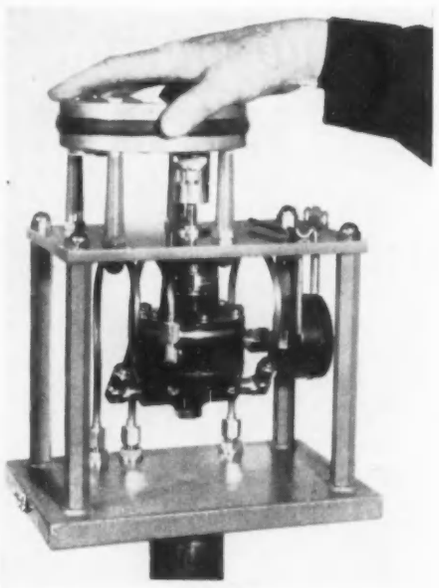


Closed Position

TEXAS RUBBER & SPECIALTY CORP.

P. O. Box 7368, Houston, Texas

NEW EQUIPMENT . . .



Gas Sampler

Replacing inadequate and inaccurate methods of periodic spot sampling, the new ARCCO continuous gas sampler, known as the ARCCO 100, over a period of seven days, will accumulate, at a constant rate, a sample of gas to a final pressure at or near 100 psig from sample source, the minimum pressure of which is not less than 125 psig. Instruments are also available for lower pressure samples.

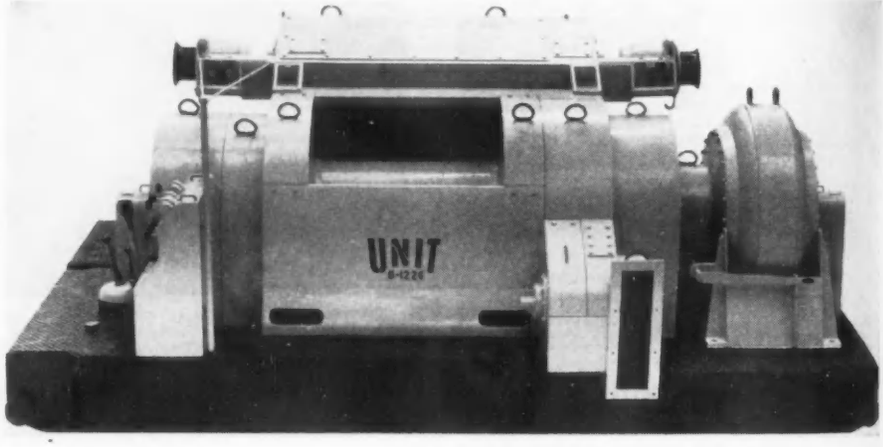
Design of the continuous gas sampler is based on the principle that maintenance of a constant rate of increase in gas pressure within a closed container from zero to any selected maximum pressure will result in a constant rate of flow of gas into the closed container. This constant rate of increase in gas pressure into a gas sample container is accomplished by means of a regulation system which is equipped with a precision drive mechanism so as to obtain a constant and predetermined rate of increase in the outlet gas pressure into the sample container, regardless of container size.

A seven-day recording chart is used to show the constant rate of increase in gas pressure from the sampler into the container. The instrument, which is primarily made for permanent installation, is small and light enough to be used as a portable gas sampler if desired.

(This item supplements American Recording Chart Company data on Pages 276-277 of the Composite Catalog, 20th Edition.)

For more data circle **No. E11** on Readers' Service Card, last page this issue.

DRILLING



Draw Works

The Unit Rig and Equipment Company has recently brought out their Model U-1220 draw works, rated at 1200 to 2000 horsepower and designed for heavy loads and deep drilling.

It features a large drum and brakes, identical drum clutches and a high degree of parts interchangeability throughout the rig. The rig is framed in two sections, each less than eight feet wide. The front section contains the drum, rotary shaft, controls and auxiliary brake. The rear section contains the three speed transmission, cathead shaft and optional sand reel, if required.

Three forward drives and the sliding gear reverse in the transmission combine with the two drum drives to give six forward and two reverse speeds at the drum. One reverse and three forward speeds are available at the rotary, catheads and optional sand reel. All hoisting drives use 1¾-inch pitch quadruple chain. Rotary and cathead drives use 1¾-inch pitch double chain.

Combination of large shafts, large bearings and short bearing center distances were designed for long trouble free life. Special attention in the design of the U-1220 was also given to its application to barge and offshore drilling operations. Corrosion problems were considered with the protecting of all adjusting linkage and exposed hardware by special plating.

(This item supplements Unit Rig and Equipment Company data on Pages 4909-4936 of the Composite Catalog, 20th Edition.)

For more data circle **No. E12** on Readers' Service Card, last page this issue.

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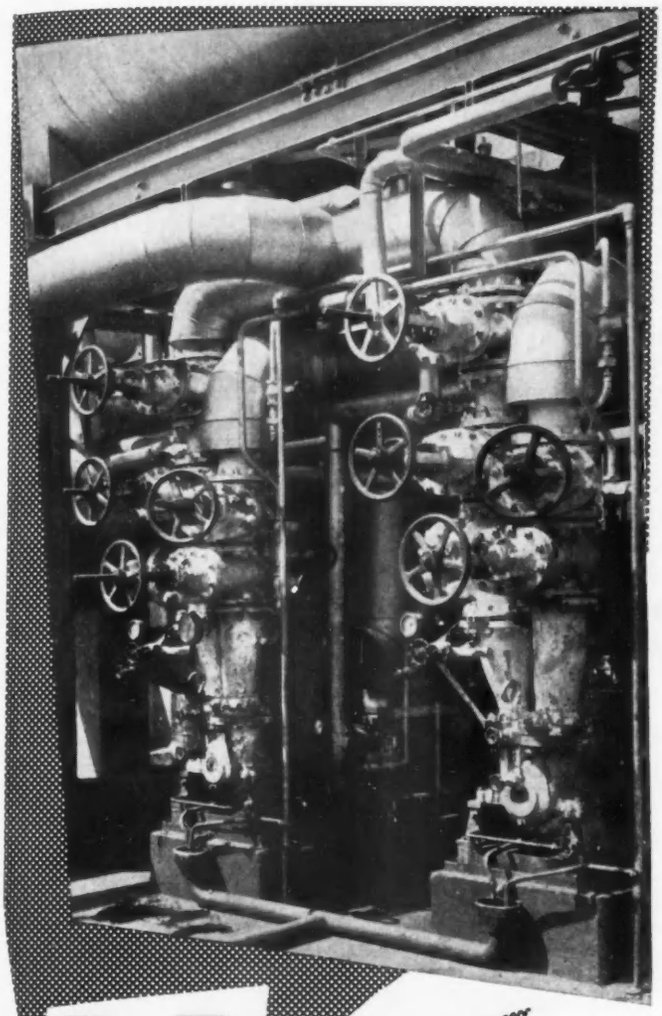

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Please ask for B&R catalog We 110e with detailed particulars on our lines of oilfield and refinery equipment.

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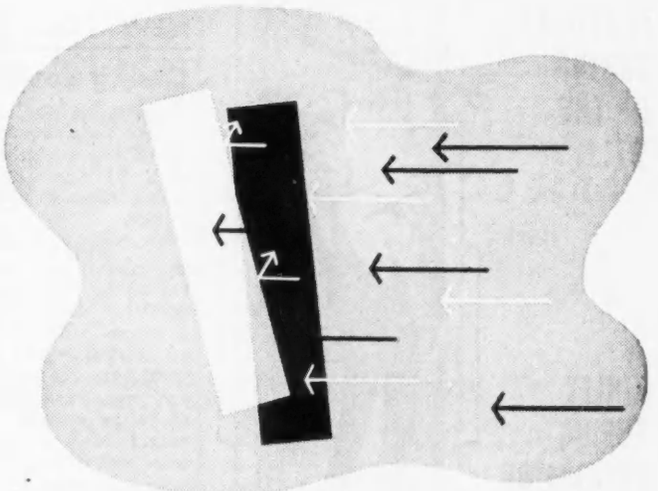

Radioisotope Laboratory For Oil Industry Opened in Houston!

A radioisotope laboratory solely for supplying the petroleum industry with special tagged compounds has been opened in Houston at 2419 South Boulevard by Tracerlab, Inc. The laboratory will stock and ship on 24-hour notice all the short lived isotopes and standard tagged chemicals now being extensively used, and will thus overcome present serious delivery problems.

Tracerlab has been supplying compounds to oil companies for several years from its Boston, Massachusetts and Richmond, California laboratories. The growing volume of orders has made it practical to establish a special laboratory in a location more convenient for the majority of users.

Many standard compounds utilized by the oil industry are to be packaged and sold under the firm's trade names: TraceSols, which are radioisotope solutions or volatile or gaseous compounds; and TraceOids, which are radioactive isotopes in the form of particulates. These compounds can be shipped on 24-hour notice or less, if the ordering firm's general authorization from the Atomic Energy Commission is on file.

Descriptive sheets on TraceSols and TraceOids, complete with specifications, prices and illustrations of some of the applications, are available on request.

HOUSTON LABORATORY

2419 South Boulevard, Houston, Texas, Tel.: Jackson 9401

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* Calif. Rep. Emsco Mfg. Co.

NEW EQUIPMENT . . .

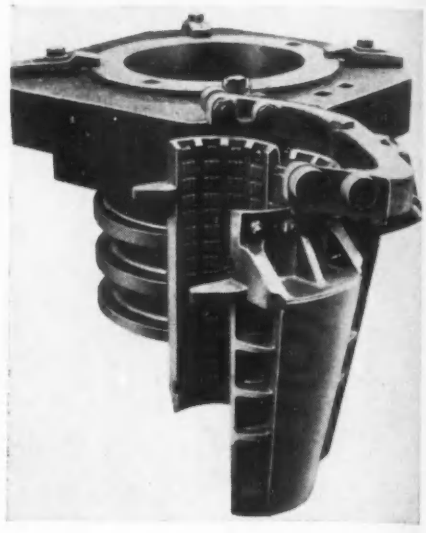
Casing Bowl

Byron Jackson Company has announced a new supplementary piece of equipment called the BJ casing bowl which enables their BJ type "B" power slips to handle casing sizes up to and including 13⅜ inches.

The master bushing in the rotary table is replaced with the BJ casing bowl, and extra-long slips designed for use with the bowl are used. These slips, together with a special carrier, can be used to replace standard slips and carrier unit of BJ power slips, extending use of present equipment and permitting handling of a greater range of casing sizes at minimum expense. The casing bowl is of a solid one-piece construction with a capacity of 300 tons.

Standard length slips of the BJ power slip handles all drill pipe and casing sizes from 2⅜ inches to 7 inches, but with the special bowl and extra-long slips, casing sizes from 4½ inches to 13⅜ inches can be handled.

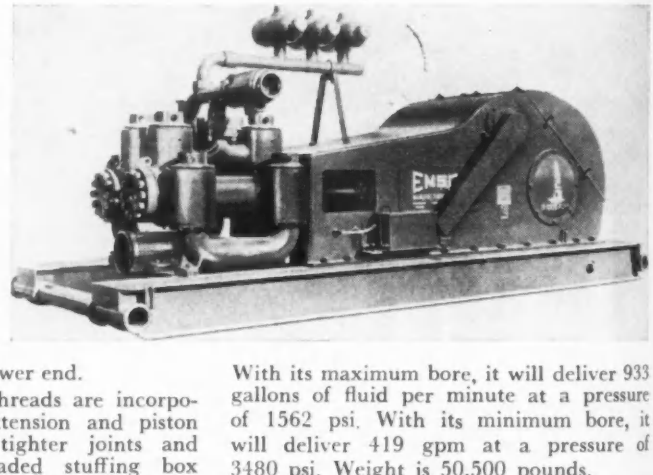
(This item supplements Byron Jackson Company data on Pages 929-980 of the Composite Catalog, 20th Edition.)



For more data circle **No. E13** on Readers' Service Card, last page this issue.

Mud Pump

The new Emsco D-1000 slush pump has been developed to meet specialized mud circulation requirements of jet bit, big hole and deep drilling. A new power-end lubrication system uses two positive-displacement plunger pumps operating in parallel to assure proper lubrication to all bearings and working parts. Long-life roller bearings are used throughout the power end.



New type tapered threads are incorporated in crosshead extension and piston rod connections for tighter joints and quick removal. Threaded stuffing box glands assure easier and more proper adjustment. Threaded valve-cover design enables quick valve inspections and reduces weight of the fluid end of the frequently handled covers.

The pump is rated at 1000 bhp input at 60 spm. Length of the stroke is 18-inch. With its maximum bore, it will deliver 933 gallons of fluid per minute at a pressure of 1562 psi. With its minimum bore, it will deliver 419 gpm at a pressure of 3480 psi. Weight is 50,500 pounds.

(This item supplements Emsco Manufacturing Company data on Pages 1465-1520 and 1521 of the Composite Catalog, 20th Edition.)

For more data circle **No. E14** on Readers' Service Card, last page this issue.

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In FORT WORTH
Loring Hotel
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Come as you are . . . . . .

New Equipment Catalogs and Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Readers' Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card. Requests are transmitted to the manufacturer as soon as received by us for mailing of desired information directly to you.

Tracer Bulletin

Tracerlab has recently issued a bulletin containing a complete description of the pertinent physical and chemical properties of a number of their specially prepared industrial process tracers. Divided into two classifications, TraceSols and TraceOids, the first group, TraceSols, contain those tracers which are soluble, either in aqueous solutions or in organic solvents, as well as volatile or gaseous compounds for tagging gases or vapors. The second group, TraceOids, comprises a wide variety of radioactive isotopes in the form of particulates of varying solubility.

Specification sheets also discuss and illustrate some of the applications for which the process tracers have been used.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Pump Booklet

"Secondary Recovery For Water Flooding Systems" is title of new bulletin issued by Worthington Corporation which offers information on water supply pumps, injection and disposal pumps.

Photographs are used to illustrate testing and warehouse facilities, and oil and water field installations. Photographs along with information explain the application of different pumps used for water supply in lakes, rivers and ponds.

Information is presented on Worthington's complete line of injection pumps. These pumps are classified in three groups consisting of low-pressure centrifugal, medium-pressure piston and vertical high-pressure plunger pumps. Also included are vertical power pump features such as complete automatic oiling system, interchangeable plunger sizes and flanged suction and discharge openings. Charts list over one hundred sizes and ratings of various type vertical power pumps.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Materials Manual

A revised "Oil Field Friction Materials" catalog has been published by Thermoid Company, featuring a comprehensive specification chart of oil field friction blocks, roll and cut-length linings for draw works, pulling machines and winches produced by the principal manufacturers of this equipment. The block size, number per set, size and number of bolts required per set and the list price are given. Specifications are in alphabetically arranged columns for easy reference.

The manual points out that all blocks that are furnished drilled for ⅜-inch bolts are equipped with a split type expanding sleeve developed by Thermoid engineers to keep blocks absolutely tight on the band, preventing any "chucking" action when brake application is made.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Diesel and Gas Engines

Publication of a new bulletin describing both types of compact, complete, self-contained Nordberg Power Chief engines is announced by Nordberg Manufacturing Company. The diesel engines are furnished as one, two and three cylinder models ranging from 10 hp to 45 hp. They are available with stub shaft or clutch power take-off and as engine-generator sets. The gas engines, built as power units and generator sets in one cylinder and two cylinder models, are rated 18 hp and 36 hp maximum, respectively. The bulletin shows product and installation views along with specifications and data about both series of engines.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

Flow Pump Brochure

A new bulletin from Aldrich Pump Co., covers design, operation and advantages of the company's Powr-Pac 2½-inch stroke direct flow pumps. Pump construction and operations are illustrated in photographs and line drawings, and tables list specifications including ranges of plunger sizes, pressures and displacements. One section, devoted to applications in petroleum and industrial use, explains how the pumps bring economy to operations such as descaling, water flooding and hydraulic testing. Other sections of the bulletin describe essential parts of the pumps.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Compressor Engines

Climax Engine & Pump Manufacturing Company has issued a special bulletin on Climax Blue Streak special power units for gas compressors. Complete specifications and dimensional drawings of the six Climax K and V-series engines are included.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Services Catalog

In a general catalog released by Dowell Incorporated, all services and products offered by the company are presented. Ways to increase production are suggested in this catalog on fracturing, acidizing, cementing, wire line, perforating, chemical cleaning and miscellaneous services. Photographs, drawings and diagrams are used throughout to illustrate equipment, treating tools and techniques used by Dowell engineers to perform services for the oil industry. Also included is a description of the company's research as it relates to the development of scientific methods.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

Diesel Booklet

Ingersoll-Rand has released a new bulletin describing features of their Type "S" and "SS" heavy duty diesel engines in sizes from 375 to 1000 hp. Complete information about lubrication, cooling and fuel injection systems of the engines is provided in the bulletin. It furnishes details about engine housing design, full floating aluminum bearings, large diameter crankshaft, gear driven auxiliaries and other features. Included also are specification and dimension sections and illustrations of the engines and component parts.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Gas and Plunger Lifts

The McMurry-Brown Company has published a catalog on their new and improved line of gas lift valves, surface controllers and plunger lifts. Illustrated with large photographs and schematic drawings, the booklet contains complete descriptive material, including prices on the McMurry-Brown gas lift and plunger lift equipment.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Bearing Extractor

Engineering Imports has released a brochure on their Tracta ball and roller bearing extractor. Diagrams and cross section drawings illustrate the operation of the new type extractor. A list of sizes of collets available is included.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

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• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 20th (1953-1954) edition of The Composite Catalog of Oil Field and Pipe Line Equipment.

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Built . . . and packaged . . . for the toughest jobs!

LINK-BELT API chain (SS type) is the most widely used in the field

NOT only is Link-Belt API Chain (SS type) manufactured for long, trouble-free service . . . it's packaged to go into use "brand new" despite the length of storage.

Link-Belt puts its chain in not one box, but *two*. The dustproof fibre carton and liner have no exposed seams —even the finest sand can't get in. And wet weather doesn't bother this durable, steel-banded package.

The care used in packaging Link-Belt API Chain is typical of the added refinements used in its manufacture. Four of these engineering extras are shown below. For the complete story, get Book 2580 on Link-Belt oil field equipment. And for prompt, expert service, call your nearest Link-Belt office or any leading supply store in your field.

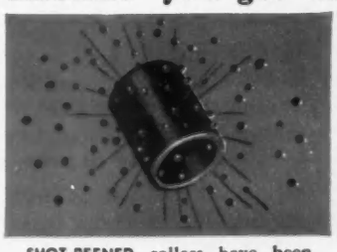
LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 13,648

Four of many 'EXTRAS' you get as standard on LINK-BELT API chain

GRINDING pins *and* bushings (all contact surfaces) to a fine micro-inch finish eliminates wear-producing surface irregularities.



SHOT-PEENED rollers have been hammered by tiny steel balls—creating added ability to withstand shock and impact.

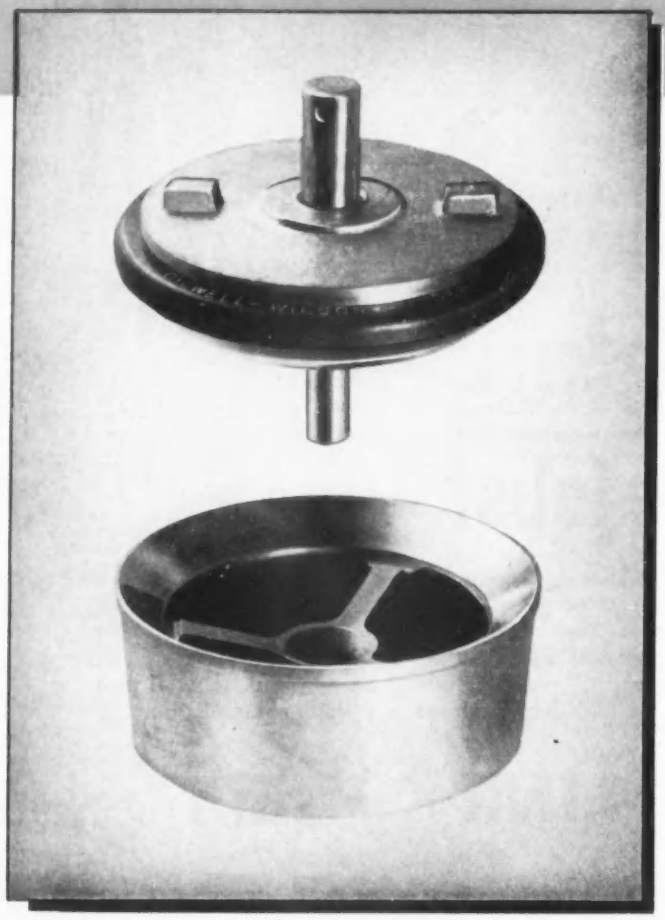
COTTERS have patented grooved shank affording tight fit in pin hole. Yet pin is easily removed or inserted. Cadmium plated.

CADMIUM PLATING OF PINS prevents rust, avoids corrosion fatigue no matter how long pins have been stored.

Maximum Areas for Free Passage of Fluids!

Maximum Metal-to-Metal Contact Areas!

...you get BOTH in these NEW Valves and Seats



...Designed Exclusively for "Oilwell" and Wilson-Snyder Slush Pumps

THESE NEW "Oilwell" fluid valves and seats are the result of intensive research . . . to design a valve that would permit free movement of drilling fluids through the passage areas, yet provide adequate metal-to-metal contact areas between the valve seat and the valve body to withstand wear from both abrasion and impact.

TRY A SET of these new valves and seats and find out for yourself how well they do their job when compared with other makes.

YOU'LL FIND

among other things . . .

(1) that the controlled-quality rubber inserts have outstanding wear-resistant characteristics;

(2) that replaceable upper and lower guide bushings practically eliminate valve-stem wear;

(3) that the combined design features of this valve make it highly adaptable to the pumping of "lost circulation" materials;

(4) and that the accurately-ground outside diameter of the valve seat minimizes the possibility of washouts in the fluid chambers.

ON SALE at your nearest "Oilwell" Store.

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UNITED STATES STEEL CORPORATION

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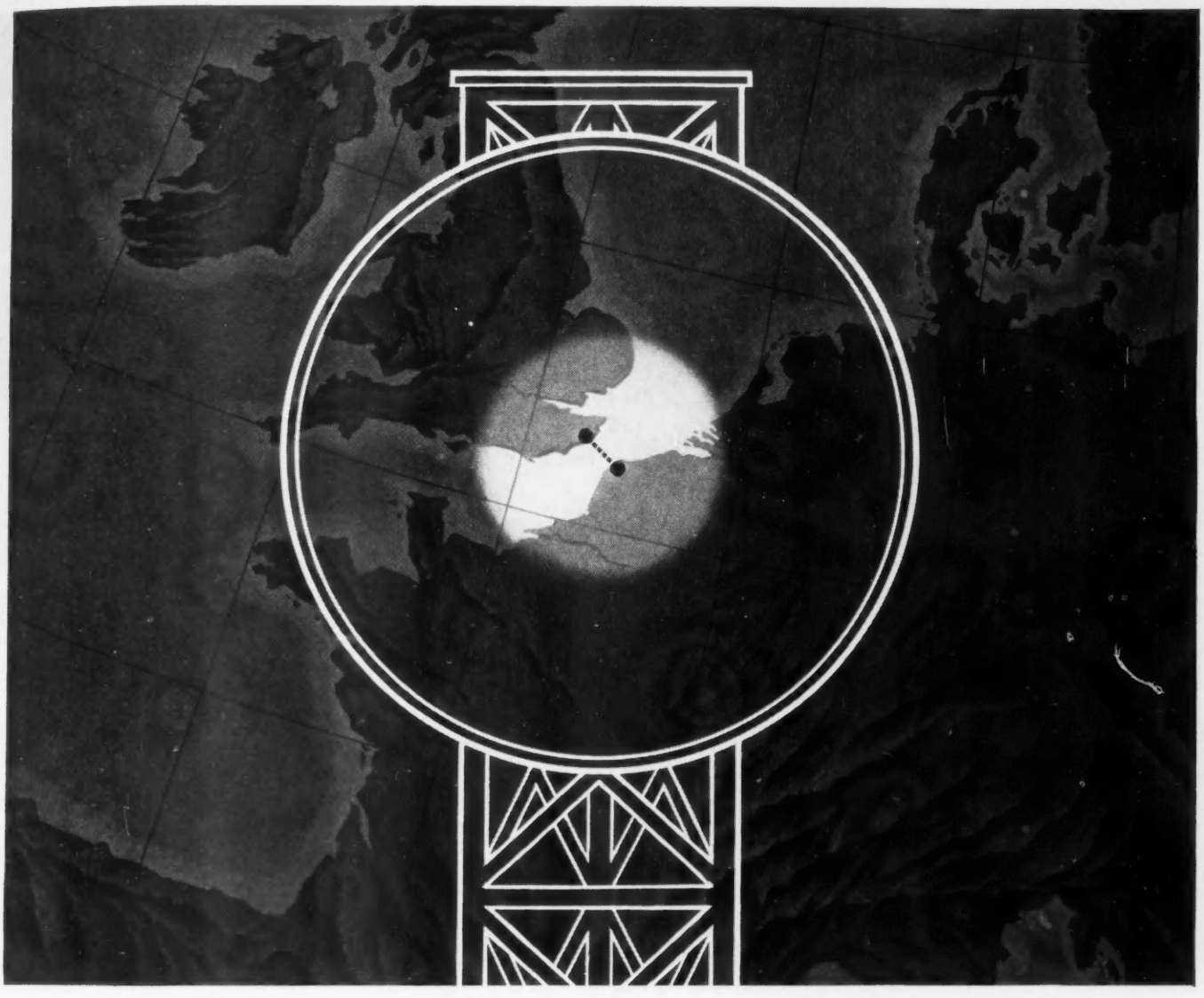
USS TRADE MARK

"OILWELL"

TRADE MARK

UNITED STATES STEEL

FEDERAL MICROWAVE—"CERTIFIED BY A WORLD OF RESEARCH"



"Hello, Calais, this is Dover calling!"

Nearly a quarter of a century ago the world's *first* public demonstration of microwave communication took place across the English Channel, when scientists of International Telephone and Telegraph Corporation established telephone and teleprinter service between Calais, France, and Dover, England.

Out of this historic experiment IT&T developed the world's *first commercial microwave link* . . . the techniques and processes that resulted in one major "first" after another . . . in multichannel relay systems, television links, multiplex broadcasting, and diplexing.

Today, through *Federal* Microwave, private companies and administrations can draw upon IT&T's unique record in microwave pioneering . . . its still expanding pool of world-wide experience in research, engineering, manufacturing and system operation.

Federal can supply all microwave needs from under one roof . . . links and networks of any channel capacity . . . also associated telephone, carrier, and VHF mobile radio equipment . . . every facility for a complete, smooth-working system . . . *"Certified by a World of Research!"*

Federal

A DIVISION OF IT&T

Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
100 KINGSLAND ROAD • CLIFTON, NEW JERSEY

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Recognize these production experts?

Each is OUTSTANDING in its Service Field!

THESE SIX BASIC BARRELS enable "Oilwell" Subsurface Pump Shops to custom-build each pump . . . to meet the specific operating conditions of the well in which it is run.

SILVERLINE . . . is an inexpensive, accurately-honed, cold-drawn, seamless-steel barrel for wells to 4,000 feet; in which loads are light, and corrosion and abrasion are not serious problems.

NICKEL-IRON . . . is an inexpensive barrel for wells to 5,000 feet where medium corrosion and medium abrasion exist. Barrels are drilled and honed from solid castings of nickel-alloy iron.

SPUN CHROMOLOY HARD SECTIONAL LINERS . . . are also suited for medium corrosive and abrasive conditions. Assembled in tough jackets of desired length, they are able to withstand the pressures encountered in wells to 7,500 feet.

HI-BRIN . . . is "Oilwell's" new special-alloy pump barrel for all depth wells where abrasion and high hydrogen sulphide corrosion are found. Our exclusive Nitrocycle bore-hardening process results in extreme hardness and permits exceptionally accurate bores over long lengths.

DI-HARD . . . in SECTIONAL LINER and FULL BARREL construction is unexcelled for deep well pumping. This material resists extreme carbon dioxide as well as hydrogen sulphide corrosion. Its low coefficient of friction resists abrasion and permits the use of metal-to-metal DI-HARD plungers which maintain uniform clearances under temperature changes, and minimize electrolytic corrosive action. Exclusive locking rings on DI-HARD sectional liners permit jacketed assemblies in pump lengths to 30 feet and over.

PROVE IT YOURSELF! You can get more barrels of oil with fewer pulling jobs when you equip each of your wells with . . . THE RIGHT "OILWELL" SUBSURFACE PUMP.

OIL WELL SUPPLY
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UNITED STATES STEEL CORPORATION

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USS TRADE MARK

"OILWELL"
TRADE MARK

UNITED STATES STEEL

...Switch to *Visco* BLUE!

● If emulsion breaking chemicals have you over a barrel . . . as to treating cost, handling, or results . . . check *now* with your Visco Man. Or, call MAdison 0433... or write Box 6826, Houston.

We know that a fast, effective Visco formula can be fitted to your problems... and will make everybody happy (including us).

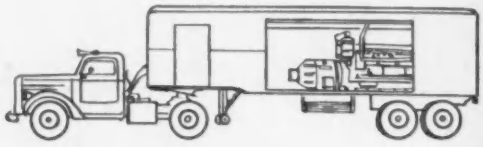
VISCO PRODUCTS COMPANY
INCORPORATED
2600 Nottingham at Kirby • Houston 5, Texas

Visco® CONSISTENTLY EFFICIENT OIL FIELD CHEMICALS

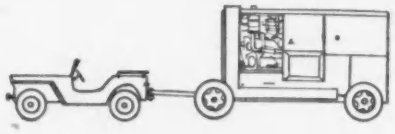
CATERPILLAR ANNOUNCES

A NEW LINE OF PORTABLE ELECTRIC SETS

Dependable electric power—where it's needed, when it's needed



CAT* Portable Electric Sets are now available in 9 models, 30 to 315 KW



USE CAT PORTABLE ELECTRIC SETS

- For dog house power
- For emergency power for pumping
- For operating in remote areas
- For pipelines—one unit protects several hundred miles

These Caterpillar Portable Electric Sets are ready to serve you in emergency or full-time operation. They are available in all the usual voltages, 50 or 60 cycle.

Each is a complete unit, with cooling system, fuel tank and switch-gear, mounted on skids, semi-trailer or full trailer, ready to be moved anywhere you need it at a moment's notice. Even the biggest trailer-mounted set is well within highway weight and size restrictions.

The units are easy to hook up, easy to operate. They deliver steady voltage and require a minimum of supervision. Low fuel and maintenance costs are added advantages.

In this new line of portable electric sets, there's one that will exactly fit your needs. Get complete information from your Caterpillar Dealer. Call him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

THE NEW STANDARD OF PORTABLE ELECTRIC POWER

CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

Please send me further information on Cat Portable Electric Sets.

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Company_____

Street_____

City_____ Zone_____ State_____

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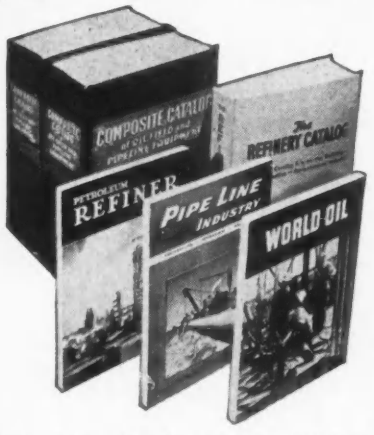

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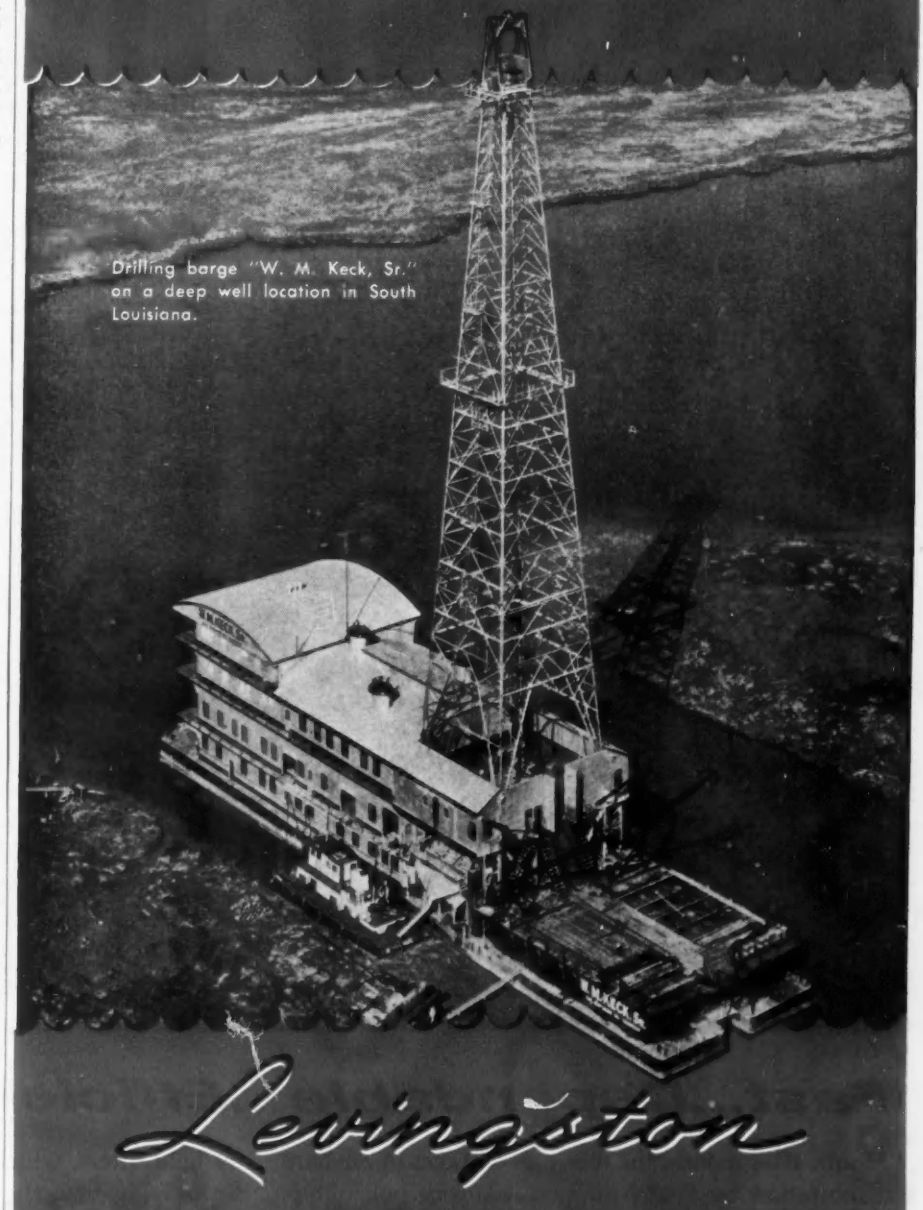
Indexed by Industrial Arts Index Engineering Index

Levingston

builds the industry's finest

SUBMERSIBLE DRILLING BARGES



Drilling barge "W. M. Keck, Sr." on a deep well location in South Louisiana.

Levingston

SHIPBUILDING COMPANY • ORANGE, TEXAS

The Oil Industry's Shipyard

COMPRESSOR BARGES • WORKOVER BARGES • OFFSHORE TENDERS • CREW BOATS • TUGS

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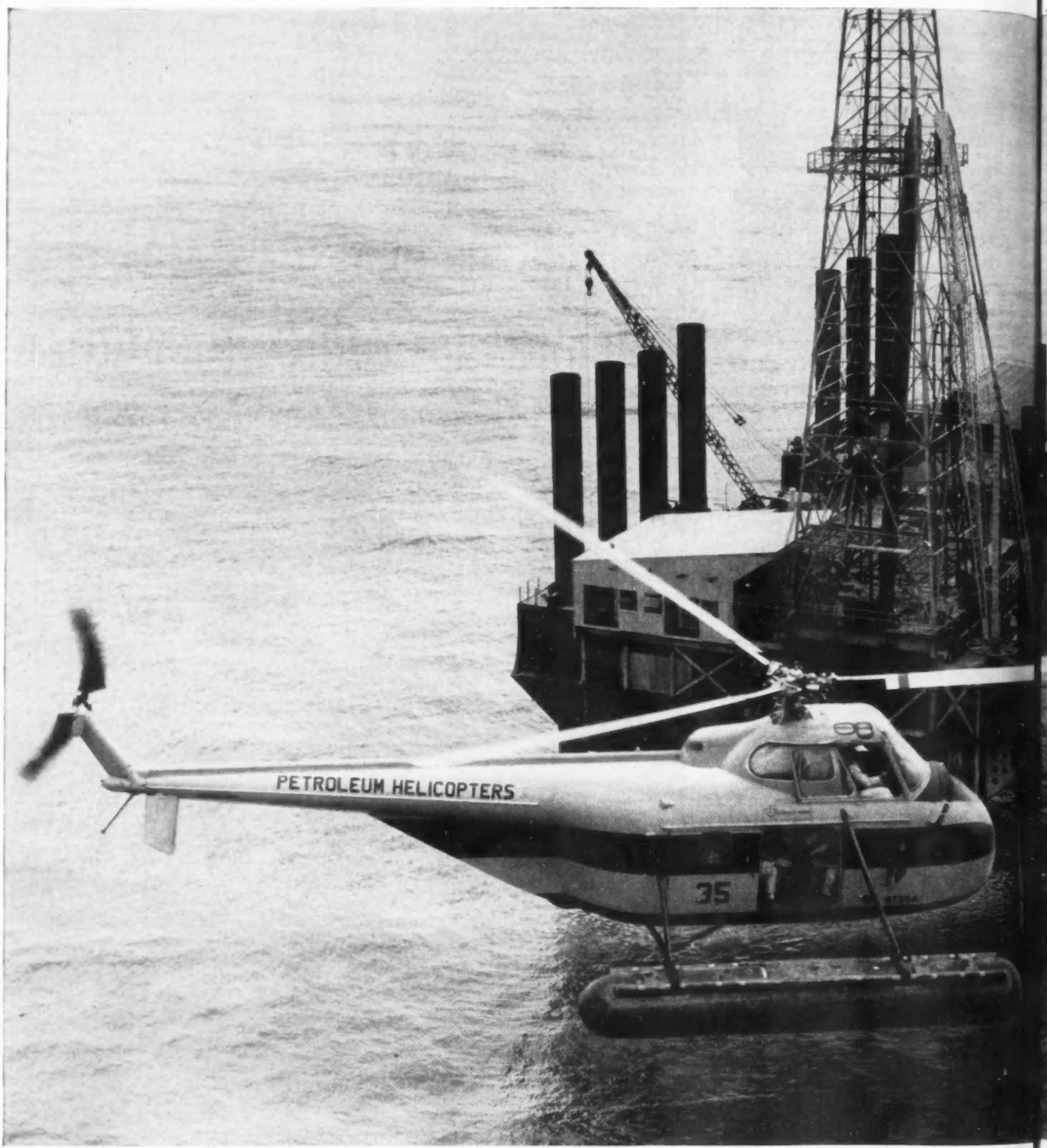


A FLOAT-EQUIPPED Sikorsky S-55, owned by Petroleum Helicopters, Inc., flies workmen to a rig offshore.

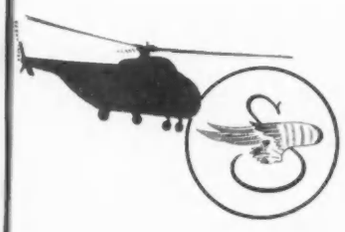
Fast...Dependable...Efficient...Smooth

Month after month, the many advantages of offshore transportation by float-equipped Sikorsky helicopters are being demonstrated in the Gulf coast drilling operations of major oil companies.

Here big S-55 helicopters regularly provide fast, dependable, efficient and smooth transportation for work crews, specialized personnel or equipment. Even the most distant offshore rigs are only minutes from shore by helicopters, which land aboard tenders or on platforms high above the sea. Sikorskys operate dependably to rigs at sea, on land or marshland.

For detailed facts about these versatile, government-approved aircraft, and information on how they can serve your company efficiently, write today to the General Manager at Sikorsky Aircraft, or telephone him at EDison 4-1071 in Bridgeport, Connecticut.

CHECK THE ADVANTAGES OF OFFSHORE TRANSPORTATION BY SIKORSKY HELICOPTERS

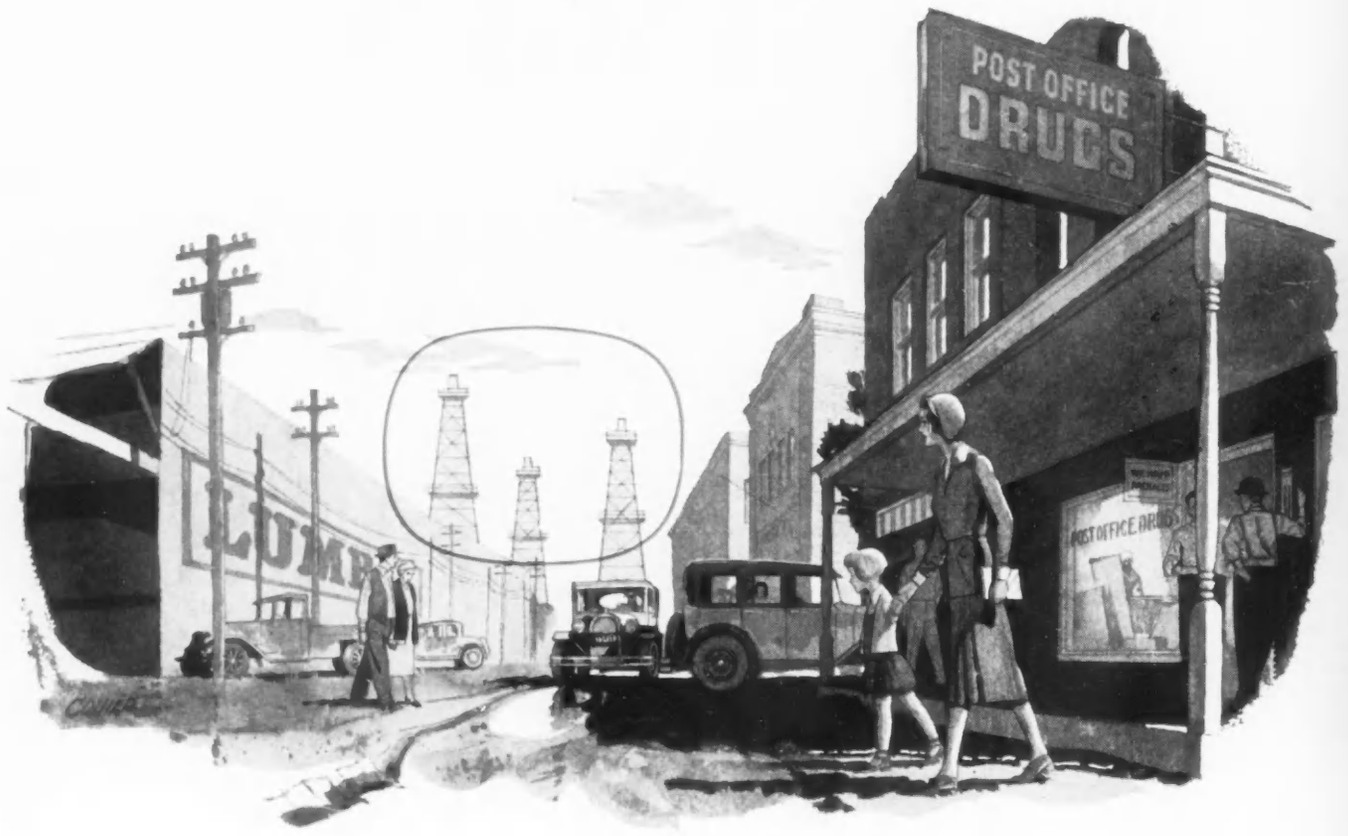


SIKORSKY AIRCRAFT

BRIDGEPORT, CONNECTICUT

One of the Divisions of United Aircraft Corporation

FIRST *to help put the future in East Texas oil production...*



Back in the early '30s, when the East Texas oil field was "wide open," the oil industry faced a major problem of price deflation. Through the guidance of the First National Bank in Dallas, proration problems were licked and prices were stabilized. Pioneering a new concept of financing for independent producers, the First provided a new method of making oil loans by helping to establish oil in the ground as a bankable commodity.

FIRST NATIONAL BANK in Dallas

Member Federal Deposit Insurance Corporation

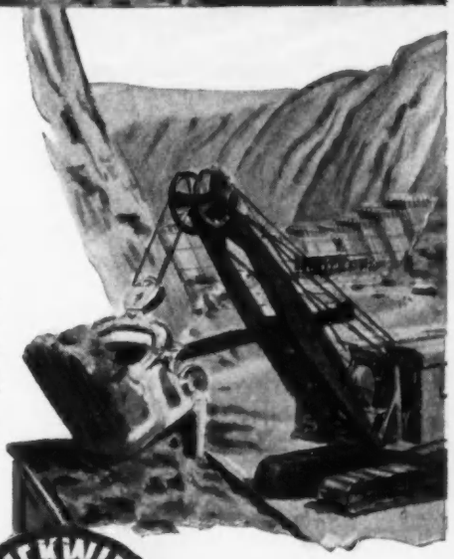
put FIRST financing in your own oil future

no match for MUSCLES OF STEEL

America's towering dams stand as mighty monuments to the efficiency of modern excavating and earth-moving equipment. On these machines, *muscles of steel*—rugged wire rope—handle with ease and dispatch the tasks that once were back-breaking for man and beast.

Wherever big construction projects are under way, you'll find Wickwire Rope at work—helping to do a better, faster and more efficient job.

Same way—in the mines and quarries ...in the oil fields and logging camps... with the fishing fleets and in materials handling. Here, too, Wickwire Rope has won outstanding preference because of its proved durability and demonstrated reliability and economy.



every industry benefits from wire rope

WICKWIRE ROPE

CF&I PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
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To Finance your Production ...See a Mercantile Man!

Whether you're engaged in exploration, lease rentals, drilling wells, building a pipeline, or refining crude, it all takes money. That's why members of our Oil and Gas Department suggest that you let them help you devise a workable plan of financing. Of course, they'll keep an eye on your tax requirements. This experienced team, with a working knowledge of oil and gas properties, provides field service advice; compiles and interprets essential statistical data; and helps you reach the sound decisions needed to make production pay. For a workable plan of financing, see a Mercantile Man.

Mercantile National Bank

Dallas, Texas

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

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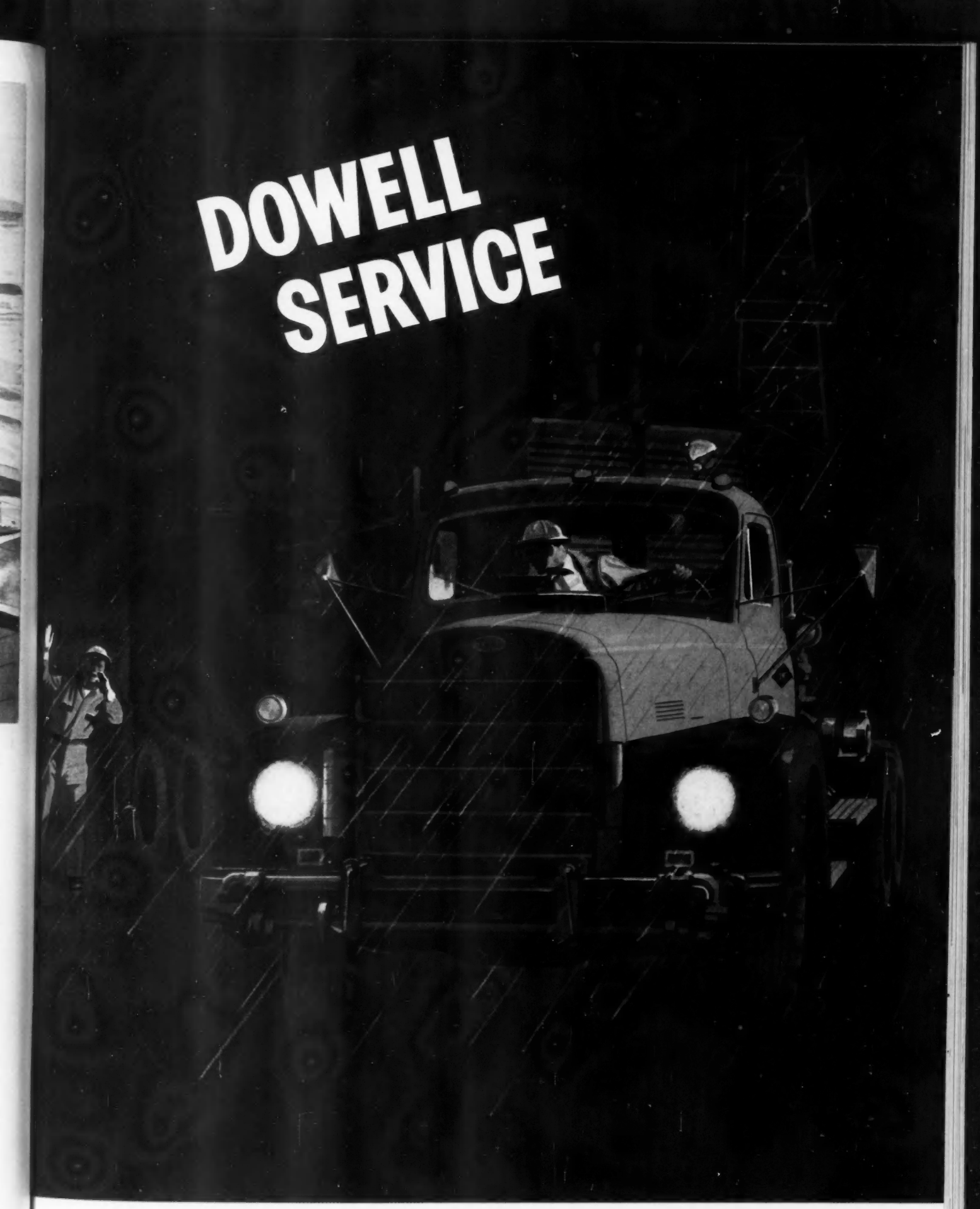

On the job . . . around the clock . . . throughout the year . . . Dowell men are at your service. They are experienced in solving oil field problems—trained by experts who developed many of the oil field services most valuable to you.

services for the oil industry

DOWELL

A Service Subsidiary of The Dow Chemical Company
DOWELL INCORPORATED • TULSA 1, OKLAHOMA

"those people at the REPUBLIC sure do know OIL Financing . . ."

The Financial Center of the Southwest

We're proud of comments like this — for they underscore this fact: From Texas to the Williston Basin, from South America to the Middle East to Canada . . . Oil men know the Republic as one of the world's leading banks in Oil Production Loans.

We'd like to serve you, too!

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CAPITAL AND SURPLUS $60,000,000
LARGEST IN THE SOUTH

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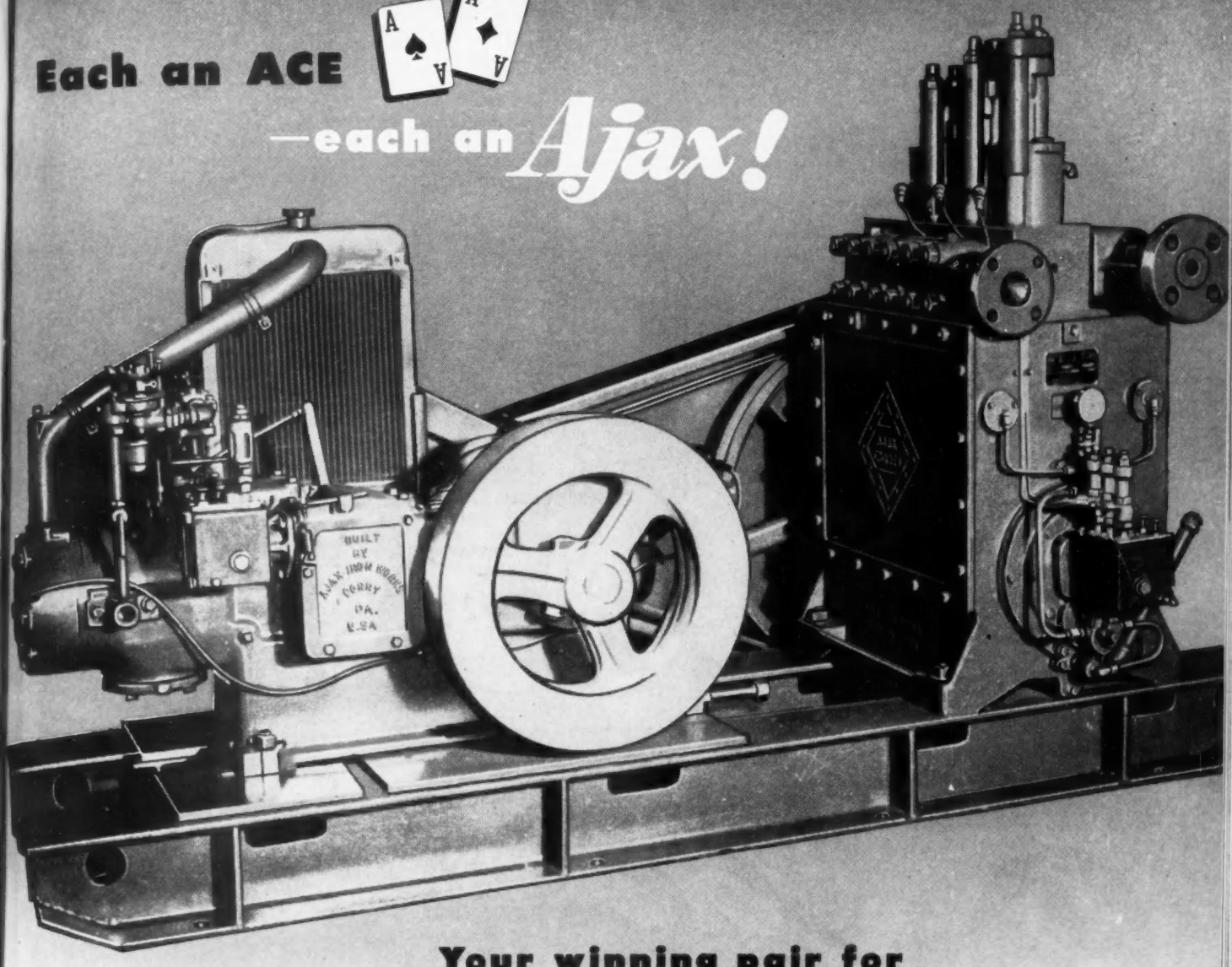
Each an ACE —each an *Ajax!*



Your winning pair for LOW COST FLUID INJECTION and HYDRAULIC PUMPING

Ajax

GAS and OIL ENGINES
PRESSURE PUMPS

This AJAX prize package is easy to buy, easy to install, and runs by itself to save money for you the year around. It will pay you from the start to get the facts on Ajax Pump and Gas Engine economy . . . ask your Supply Man today about these dependable performers that *use petroleum products while they build petroleum profits!*

AJAX

PESA

AJAX IRON WORKS

Builders of GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM DRILLING ENGINES, INDUSTRIAL STEAM ENGINES

CORRY, PENNSYLVANIA

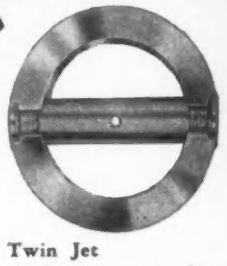
Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA.
R. B. MOORE SUPPLY CO., BOLIVAR, N.Y. • BETHLEHEM SUPPLY CO., TULSA, OKLAHOMA

4-Way Jet
For equalizing cement around your casing in squeeze operations!

Torpedo Jet
For maximum penetration and hole size in open hole shooting!

Perfo-Jet
For deep penetration . . . positive perforation without casing or cement damage!

Swing Jet
For maximum penetration in permanent-type well completions!



Twin Jet
For jet advantages and performance at bullet prices!

OIL WELLS . . . just like oil men . . . are individuals. There are few fixed rules that apply to all wells because of the varied conditions encountered during drilling or completion operations. Welex . . . to meet the perforating needs of every well completion job . . . and to give you the *jet* advantages of positive perforation and maximum penetration . . . has developed a full line of specialized perforators and Welex engineers will help you select just the right jet for your well . . .

ORIGINATORS OF Welex JET PERFORATING

Welex JET SERVICES, INC.

Call Welex and be SURE!

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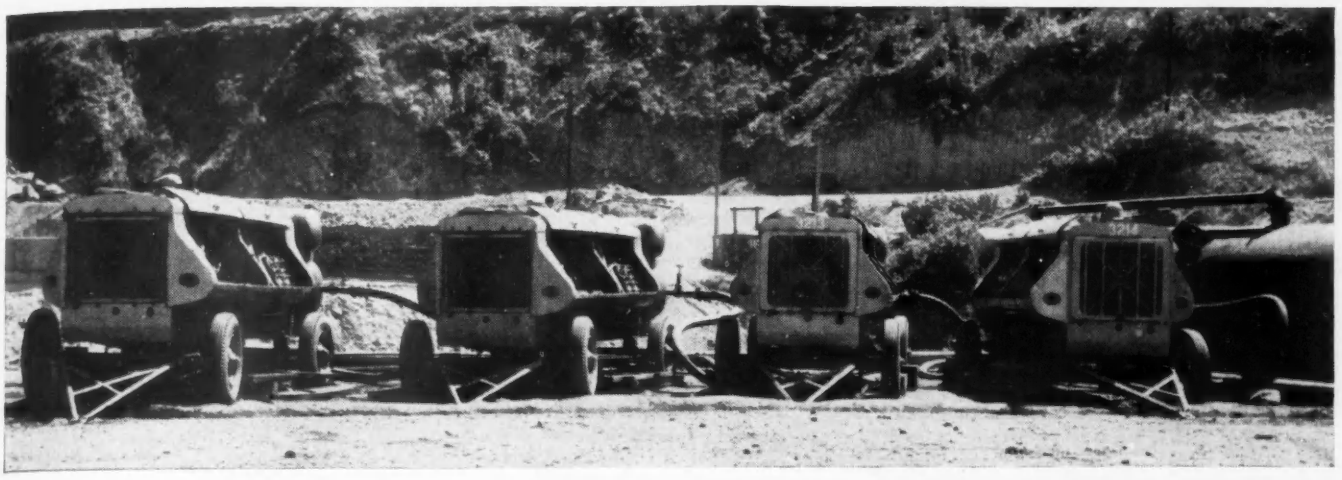
(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

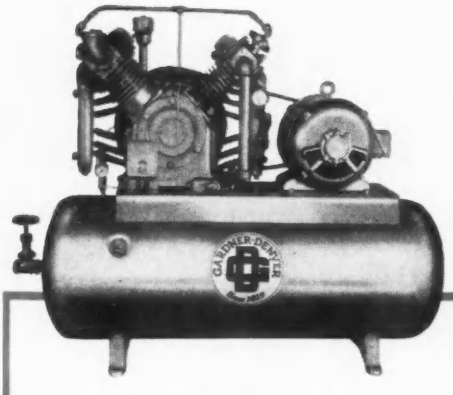
Compressed air going to work on your rig?

...remember GARDNER-DENVER quality



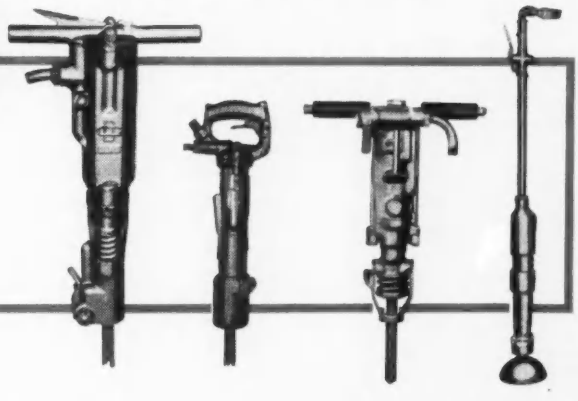
On air-drilling assignments, Gardner-Denver portable compressors operate continuously at any altitude, in any weather.

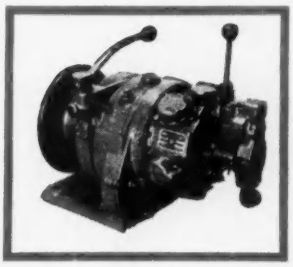
Compressed air power — muscle-saver on the new and modernized rigs — must be as dependable as every other item on the rig. That's why Gardner-Denver compressors, air hoists and tools are first choice among oil men who know Gardner-Denver quality.



Tank-mounted compressors with Timken roller main bearings and many other quality features. Compressors also available without air receiver.

Also hard-hitting breakers for concrete demolition — rock drills — tampers — spaders — sump pumps — and other useful air tools.

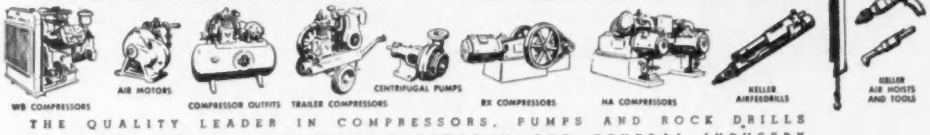




Powerful air hoists for lifting, pulling, maneuvering.

GARDNER-DENVER Since 1859 K KELLER TOOLS

GARDNER-DENVER



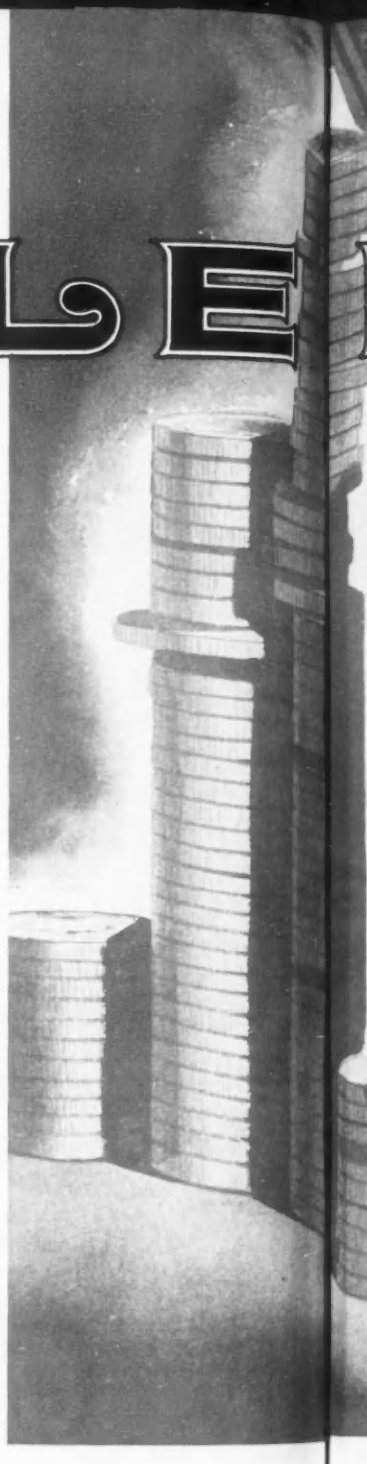
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco • New York • Chicago • Pittsburgh • Denver • New Orleans • Continental Supply Co., Continental Bldg., Dallas, Texas • Export Division: 30 Rockefeller Plaza, New York, N. Y. • Republic Supply Co. (Of Calif.), 2600 S. Eastland Ave., Los Angeles, Calif.

GAMBLE



THE GAMBLERS of the great gambling casinos of the world are pikers compared to these four players. They gamble against odds that make the odds of Reno, Las Vegas, and Monte Carlo pale into insignificance by comparison.

But no gamblers ever try harder to take the gamble out of their work than these four players. Their odds are the vagaries of nature. Their skill in meeting the odds depends on science, engineering, invention. P.E.S.A.'s nine thousand engineers and the engineers of their great customer, the oil-producing industry, work around the clock to reduce these odds.

These four players are:

P.E.S.A. Manufacturers venturing their capital to make better tools and equipment to stand the extreme pressures, abrasive cutting, shock, and mounting temperatures necessary to keep the wells going to three-mile depth and beyond.

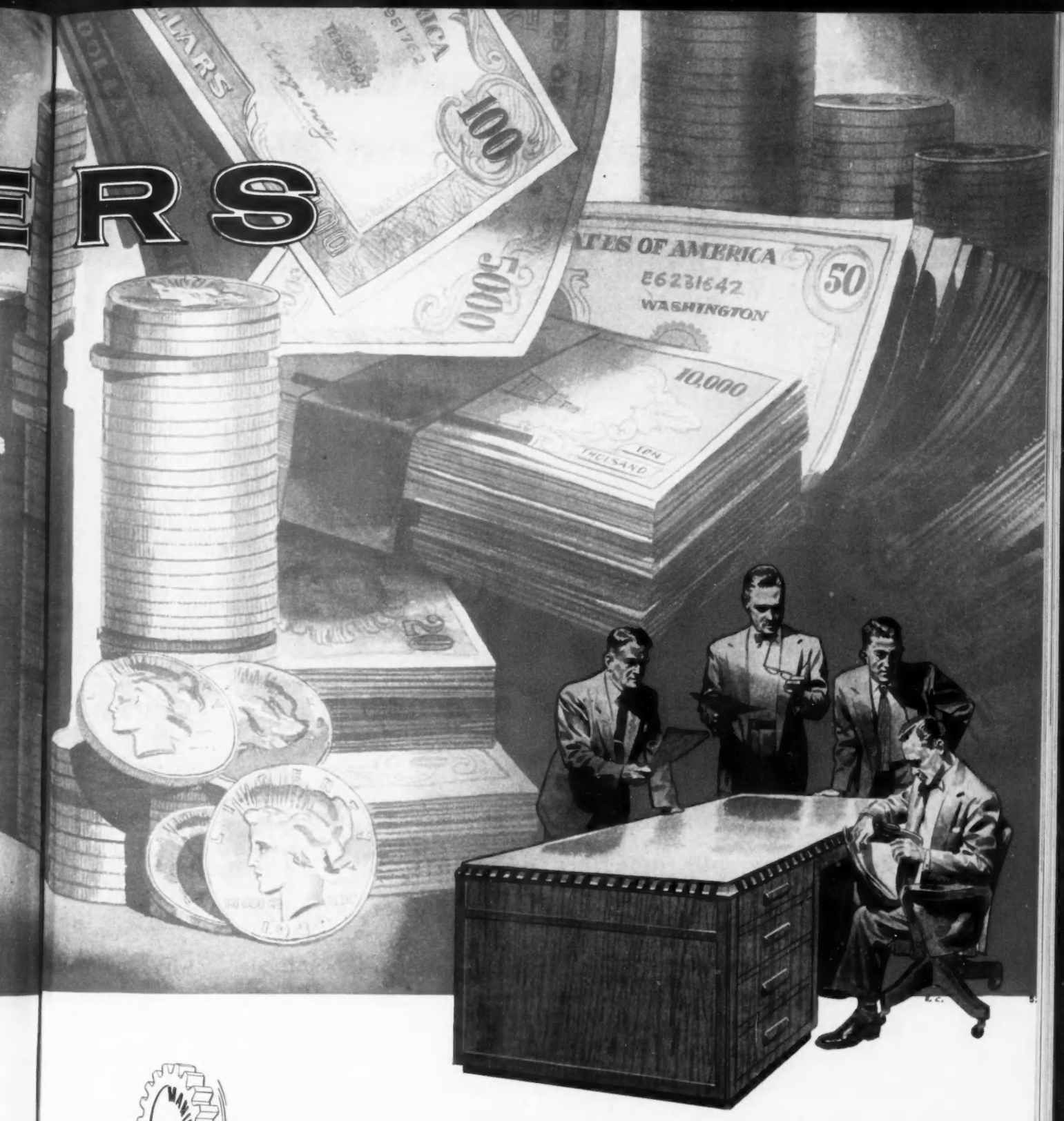
P.E.S.A. Supply Companies venturing their capital to assure oil operators getting ALL the equipment necessary for carrying on oil field operations *when* they want it and *where* they want it.

P.E.S.A. Service Companies venturing their capital in order to carry on expensive basic research necessary to solve the highly technical problems connected with much oil field service; in order to develop and construct the equipment necessary to adapt theory to practice; in order to provide the highly skilled scientists, engineers and technicians necessary to perform the services and to lend their know-how, integrity, and sincerity of purpose, to help analyze well problems and recommend effective, economical solutions.

Oil Companies venturing their capital to obtain oil leases; to apply geology and geophysics to finding favorable formations; to spending great sums of money to find if oil-bearing formations exist, and then to provide the large amount of money necessary to bring the oil out of the ground and transport it to the refineries.

• • •

There are no greater gamblers than the intrepid, risk-taking pioneers who have developed the oil industry into one of the world's greatest and most important businesses. They take risks, but they are calculated risks based on all the scientific knowledge that brilliant men can bring to bear on problems connected with exploring and operating in the depths of the earth. The depletion allowance is recognition of this risk and is a necessary incentive. The aggressive venturism of hardy men also finds its reward in being able to operate under the American free-enterprise system. That's the secret of America's greatness.



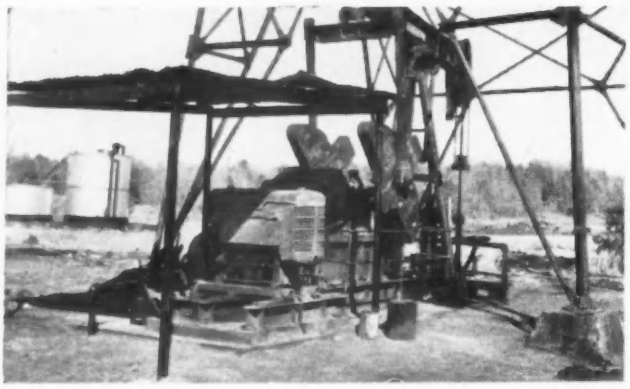
MANUFACTURER
SUPPLY
SERVICE

P.E.S.A.*

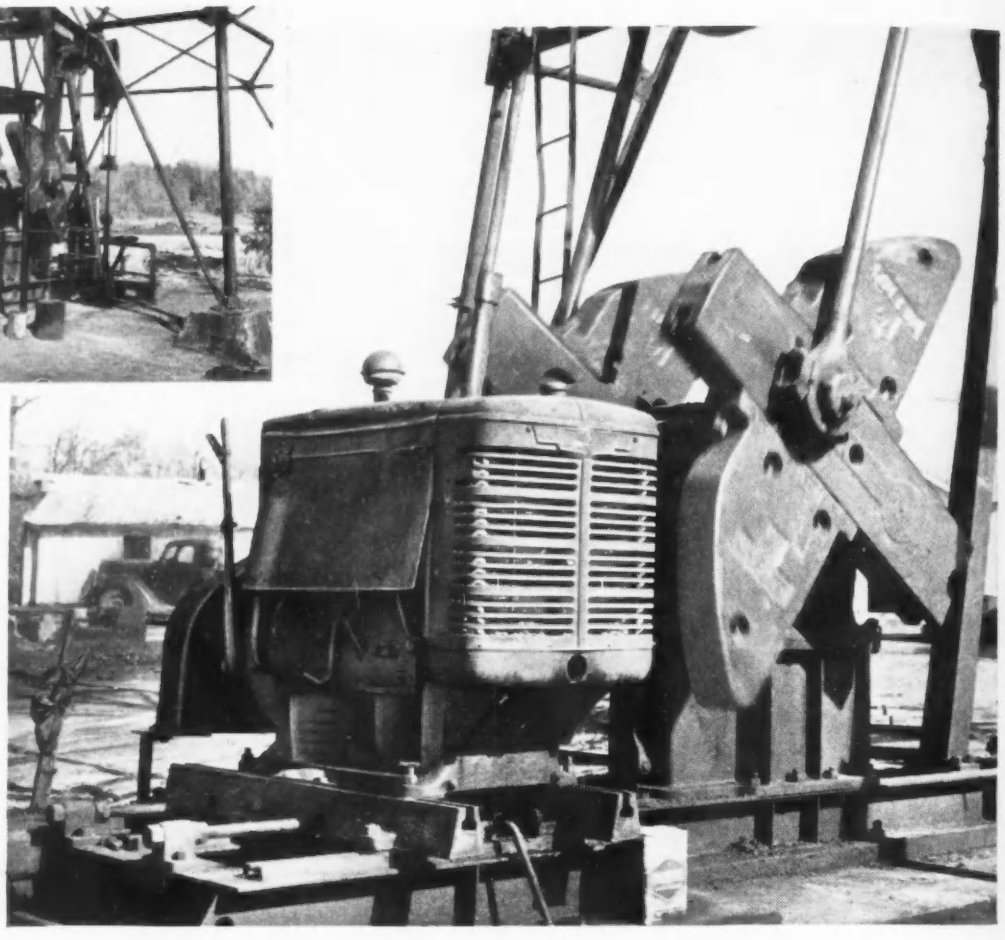
* Petroleum Equipment Suppliers Association

Composed of: manufacturers whose plants make the finest precision equipment . . . *supply stores* who add two other ingredients of value — where you want it — when you want it . . . *service companies* who make available to their customers the practical results of the theoretical research of some of the most brilliant scientific and technical men in the world.

"Our U-264s Pump Around-the-Clock After Decade of Hard Work"



THIS INTERNATIONAL U-164 is one of five on the Berry wells and was purchased as a used engine six years ago. It has operated with only a ring and valve overhaul since that time.



STARTING A SECOND DECADE OF GOOD WORK, this INTERNATIONAL U-264 pumps 515 barrels in 24 hours from depth of 2030 feet in the field near El Dorado. Berry uses nine INTERNATIONAL engines on his wells in this field.

Arkansas pumper finds nine INTERNATIONALS, all over five years old, provide dependable, low-cost power on the pump jacks

It takes 25 barrels of fluid to net one barrel of crude oil from the wells J. E. Berry of El Dorado, Arkansas, owns near that city. And that's the big reason two rugged INTERNATIONAL U-264 power units have been driving the pump jacks on an around-the-clock basis for the past four years.

Superintendent H. S. Graves reports:

"Our two U-264s run 24 hours a day on these 2030-foot wells—and they give such good service it is hard to realize they have been on pump jacks for a decade—having been six years old when we bought them four years back."

Money can't buy finer pumping engines than INTERNATIONALS—and the fellow who can supply the information to back up this statement is your nearby INTERNATIONAL Industrial Power Unit Distributor or Dealer. There are 12 pumping engines in the IH gas line ranging from 59.5 to 1091 cu. in. displacement—trouble-free, durable, low-cost pumping power that can cut maintenance and operating costs on your pump jacks.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL HARVESTER

INTERNATIONAL®
INDUSTRIAL POWER
MAKES EVERY LOAD A PAYLOAD

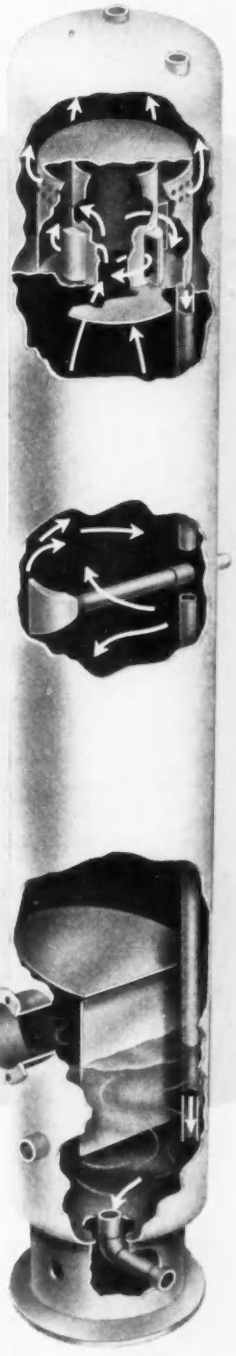
(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Why is Dunham Tanks forging ahead?

(NO. 6 IN A SERIES OF 10 ADS.)

New, Advanced Vertical LP Oil & Gas Separator:

better because..



Larger oil and gas capacity!

The new **Dunham inlet diverter!** Diverts the well stream into a thin film swirling around the inside wall causing maximum-efficient primary extraction.

The **cyclonic mist extractor** completes the separation of mist from gas. The design utilizes centrifugal force, impingement, change of direction, contact scrubbing and change of velocity to give mist-free gas.

Look to Dunham for continued leadership in modern engineering advancements in all phases of oil field production equipment!

Products:

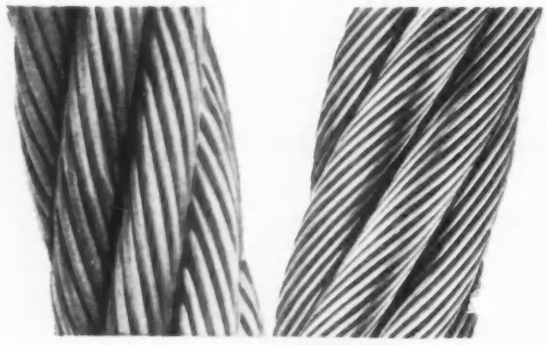
Welded and Bolted Steel Tanks, Steel Stairways and Walkways, Vertical and Horizontal Oil & Gas Separators, Emulsion Heaters and Treaters, Indirect Gas Heaters, Cold Separation Units, Two Stage Separation Units, Gas Dehydration Units, Three Phase Separators, Free Water Knockout, Servel Refrigeration Units and LeRoi Compression Units.

ANDERSON-DUNHAM, INC. DUNHAM TANKS TANK DIVISION

DUNHAM TANKS

Division of Anderson-Dunham, Inc., Baton Rouge, La.

Plant: Minden, La. Sales and Service: Shreveport, La.; New Orleans, La.; Lafayette, La.; Perry, Okla.; Seminole, Okla.; Tulsa, Okla.; Ardmore, Okla.; Odessa, Tex.; Corpus Christi, Tex. (Lester Moore Tank & Supply Co.); Houston, Tex.; and, Natchez, Miss.



ROEBLING ANNOUNCES ITS NEW

Royal 1105 Blue

WIRE ROPE . . . 15% STRONGER THAN YESTERDAY'S GUARANTEED STRONGEST!

15% MORE STRENGTH is a whopping improvement. But translate that extra strength into terms of increased service life and you've really got something to brag about.

★ What's more, Roebling is pulling no punches on the variety of this new rope that will soon be available. You'll be able to get **ROYAL BLUE** Wire Rope in EVERY DIAMETER from ¼" to 3½"... in EVERY STANDARD CONSTRUCTION with an independent wire rope core.

★ In addition to new high strength, Roebling type 1105 wire – the finest high carbon rope wire ever produced – gives **ROYAL BLUE** Wire Rope amazing toughness and resistance to impact, crushing, abrasion and fatigue.

★ As the first step toward completely new service economy, write us for the whole story on **ROYAL BLUE** Wire Rope, or contact your distributor or nearest Roebling branch office.

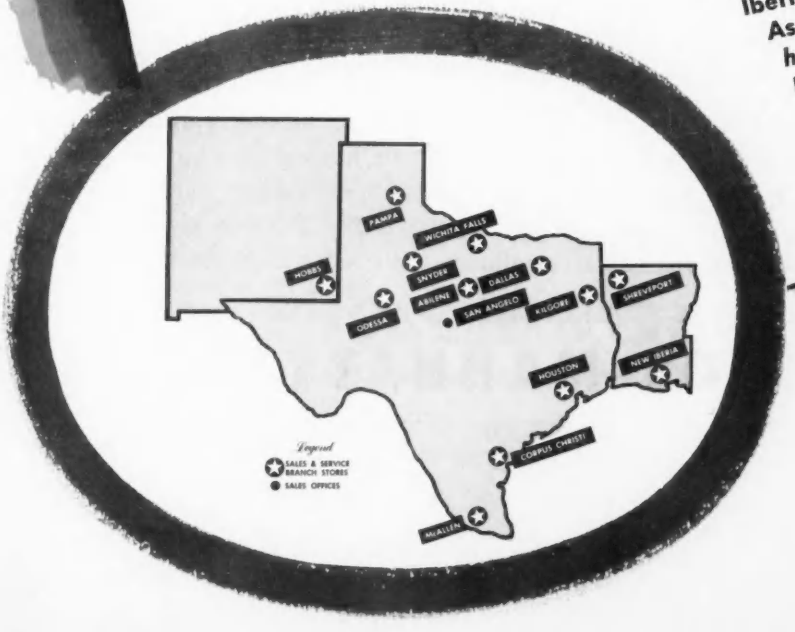
ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

and now the BIG BOYS

When you want to make more hole in a hurry these new, big Waukesha V-12 engines are the answer for faster penetration and deeper drilling. Waukesha Sales and Service, Inc. is proud to add these engines to the famous line that we sell and service. Like your other Waukesha engines, these will be treated best at home—and home is Waukesha Sales and Service, Inc. in Pampa, Hobbs, Snyder, Abilene, Wichita Falls, Odessa, San Angelo, Dallas, Kilgore, Shreveport, Houston, New Iberia, Alice, Corpus Christi and McAllen. As near as your phone and on the job 24 hours a day, Waukesha Sales and Service, Inc. is your Waukesha engine's best friend.



WAUKESHA

Sales & Service, Inc.

1422 MAURY ST. • HOUSTON, TEXAS

EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

HOW TO BUY ROTARY HOSE THAT LOWERS DRILLING COSTS

. . . gives you "More Use per Dollar"

Look for a rotary hose construction with engineered features that assure safe, easy handling . . . a strong, flexible hose with a streamlined coupling that protects you against costly leaks and blowouts on the job.

A hose that is strong, flexible and correctly balanced, without being bulky, holds steadier in the derrick — even under the high pressure of deep drilling. If the hose is also light in weight it is easier to make-up on the rig . . . easier and *safer* to transport from hole to hole without damage or accident. Insist on a hose with strength members properly engineered and positioned to assure maximum flexibility . . . to resist kinking that can cause internal weakness and eventual hose failures. Insist, also, on a hose coupling that is streamlined with no protruding lugs or collars to interfere with easy handling, a coupling specially engineered to guard against leaks and blowouts . . . to add to the long, trouble-free life of the hose and reduce rotary drilling costs.

Specify, by name, the rotary hose engineered to give you dependable service under all drilling conditions . . . specify "Ray-Man" CBL Rotary Hose.

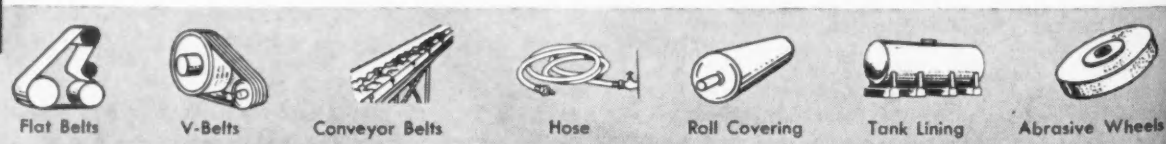
RAY-MAN CBL ROTARY HOSE

Special high-tensile steel cable wire reinforcement, precision wound under tension, gives Ray-Man CBL Rotary Hose a degree of flexibility—and safety—never before equalled. With strong, flexible strength members, Ray-Man offers maximum resistance to accidental crushing. This flexibility adds to safety and long life . . . makes Ray-Man easier to transport and rig-up without accident. Manhattan's streamlined, built-in coupling features the blow-out proof "Lip-Lok" seal that tightens under pressure. It is designed without protruding lugs or flanges — nothing to cause fouling or damage. These features of Ray-Man CBL Rotary Hose add up to the highest safety factor, longest life and lowest cost per foot drilled for your drilling operations . . . "More Use per Dollar." Write for Bulletin #6743. RM 510

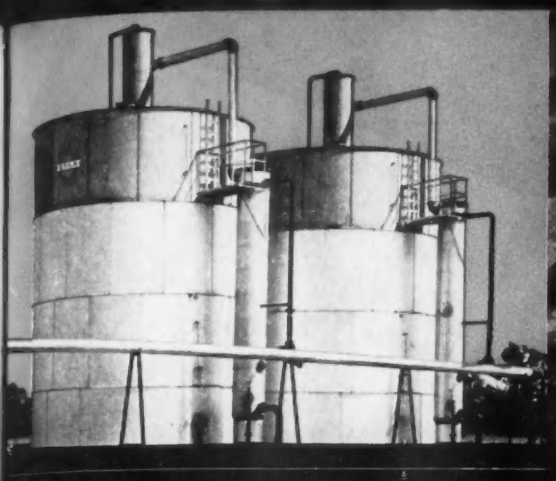
R/M

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls



Entire 8,800-Acre Field Containing 2,300 Wells Now Served By Two BS&B Waterflood Treating Plants

An Actual Case History From Our Files

Two recently completed BS&B Waterflood Treating Plants are now serving the operators* of the unitized Lake Centralia-Salem Oil Field, approximately 6½ miles long and 2½ miles wide, in southern Illinois.

PROBLEM: At the time of unitization, this field contained more than 365 tank batteries servicing approximately 2,300 wells. Most of these tank batteries were 10 years old or more, and with gas depletion and the necessity for installing gathering lines for waterflooding, a unique treating problem was presented.

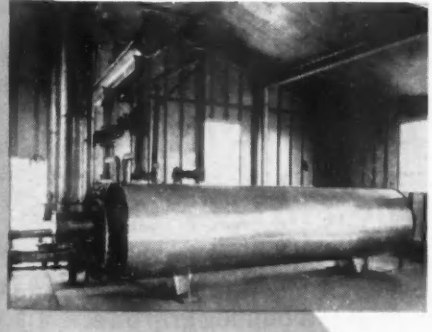
SOLUTION: It was decided to consolidate the entire production through two large treating plants, each of which was to have an initial design capacity of 10,000 BOPD and 35,000 BWPD, with an ultimate capacity of 30,000 BOPD and 115,000 BWPD. Each plant was to consist of the following basic items of equipment:

1 BS&B 10′ x 28′ Freewater Knockout
2 BS&B 70LSH Steam Generators
2 BS&B 30″ x 21′ x 6″ Heat Exchangers
2 BS&B 21′-6″ x 32′-2″ 2,000 Bbl. Settling Tanks
4 BS&B 38′-7⅝″ x 24′-1½″ 5,000 Bbl. Stock Tanks

Plants were to be so constructed that equipment could be added or removed without interrupting operations. Water of 1.05 specific gravity was to be removed from oil of approximately 37° API.

RESULT: Test results on these plants have been most satisfactory. Heat exchangers were transferring 2,000,000 BTU/Hr./heat exchanger under medium load with only one steam generator firing. Water carry over from the freewater knockout was less than 1%. The grind outs do not exceed .002 to .003%.

* Name supplied on request.

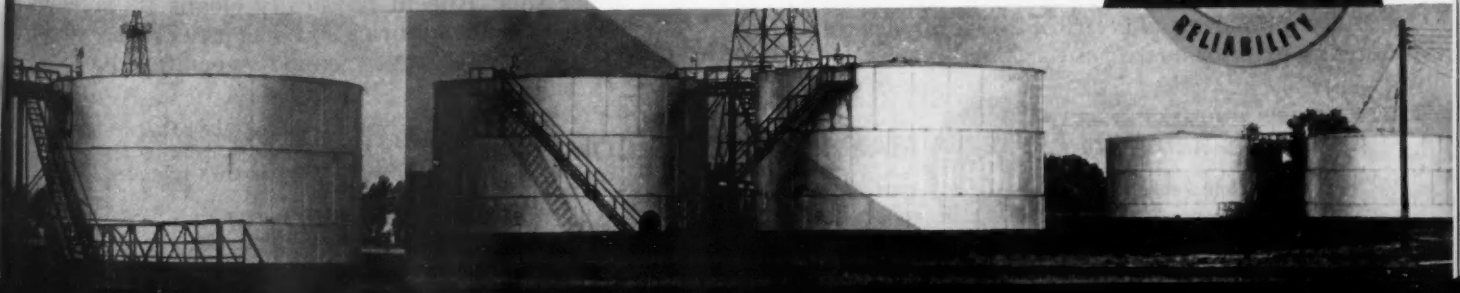


BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-B6

1708 West Main Street • Oklahoma City, Oklahoma

EFFICIENCY OVER 60 YEARS **BS&B** RELIABILITY



HILLS AND VALLEYS MAKE BETTER STEEL DRUMS

GREATLY MAGNIFIED, this photo shows Rheem steel after shot-blasting. *Physically* cleaned and roughened, it offers a better gripping surface for applied linings or coatings.

THIS SHOT *is the secret of Rheem's longer lasting steel drums*

Look at the insert above. It shows you the hills and valleys in a piece of shot-blasted steel . . . the steel Rheem uses to give you a better steel drum.

This shot-blasting—the first and most important step in preparing the steel for forming—*physically* cleans and roughens. Millions of carefully sized high-carbon steel pellets bombard both sides of each steel sheet . . . blasting away scale . . . roughening the surface . . . carefully preparing the metal to receive protective linings or exterior coatings.

As a result, when we apply an interior lining or outer coating to a drum, it gets a bulldog grip on scientifically roughened steel. We get a better bond of steel and coating. You get a better drum. Also, because Rheem's shot-blasting gives the steel a "passive" surface, it retards oxidation of *uncoated* sheets.

Next time you place an order for steel containers, remember this: Rheem *physically* cleans its steel by shot-blasting before fabrication. For *any* drum—plain, lined or decorated—that means longer life.

YOU CAN RELY ON Rheem MANUFACTURING COMPANY

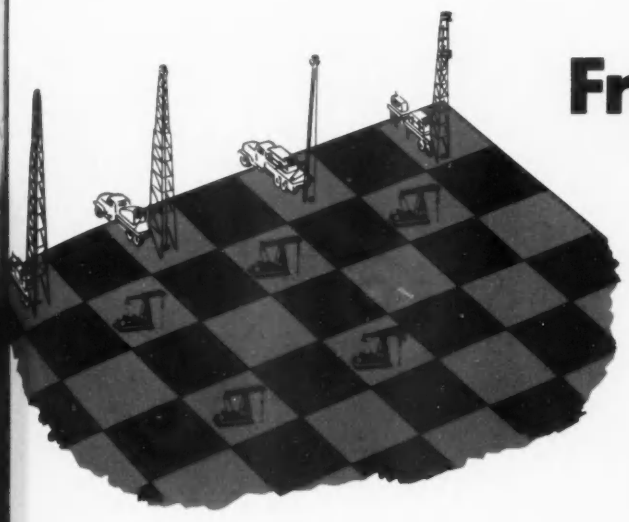
1025 Lockwood Drive, Houston 20, Texas

4901 Jefferson Highway, New Orleans 20, Louisiana

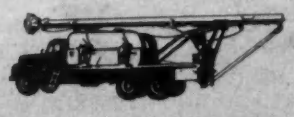
World's Largest Manufacturer of Steel Shipping Containers

RICHMOND AND SOUTH GATE, CALIF., CHICAGO, NEW YORK, LINDEN, N. J. AND SPARROWS POINT, MD.

"It's better to ship in steel"



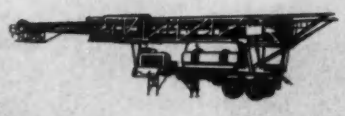
Franks Units Offer the *Most Profitable* Location-to-Location moves



Cruiser

Rocket

Clipper



Comet

Savings in Operation costs with Franks units enables contractors to pay for them quickly

If moving from location to location is expensive, the contractor pays.

If moves are quickly and inexpensively accomplished, the contractor can get back on the paying jobs sooner.

Franks made its name originally by cutting down moving time and costs by putting units on wheels, providing portable masts that moved strung up; by making rig-up and down time a matter of minutes.

Many operators are making the payments on their units with the savings in Franks moving rig-up and down costs.

Contractors also know Franks units are preferred or accepted by superintendents. They need never fear having a Franks unit stacked in the yard when jobs are available.

Contractors know Franks units are faster too. The Rocket and Clipper, for example, require no guying of derrick to the ground; provide faster and safer operation since derrick type mast permits use of Franks air lift rod transfer and has provisions for quicker stacking of rods and tubing. Check Franks servicing units and drilling rigs before you buy.

FRANKS MANUFACTURING CORP.
Subsidiary of Cabot Shops, Inc.
Domestic and Export
Box 3218, Whittier Station
Tulsa, Oklahoma

FRANKS
A SUBSIDIARY OF CABOT SHOPS, INCORPORATED
WELL SERVICING AND DRILLING UNITS
TULSA, OKLAHOMA

"on the SPOT" FIELD SERVICE

Only Franks offers "on the spot" field service, with stock of parts and factory-trained personnel at: Alice, Compton, Casper, Farmington, Great Bend, Houston, Kilgore, Odessa, Seminole, Edmonton and Tulsa.

KERMAC
The Right Men and Equipment for any Drilling Job...
ON LAND AND AT SEA
KERR-McGEE
OIL INDUSTRIES, INC.
General Offices • Oklahoma City
KERMAC

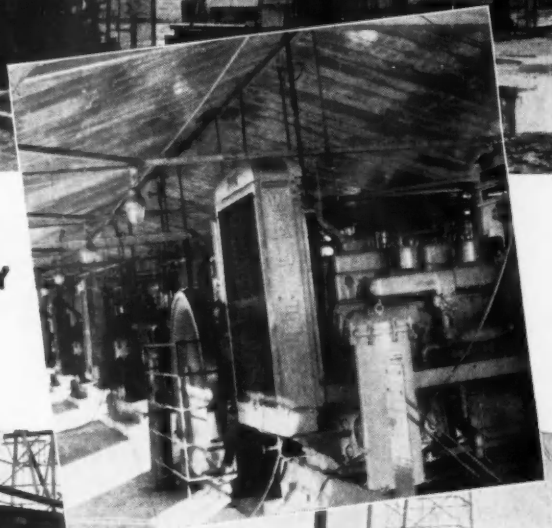
World's Finest Oil Field Power
WAUKESHA

ENGINES and POWER UNITS 10 hp. to 1135 hp.

Send for

BULLETIN 1079

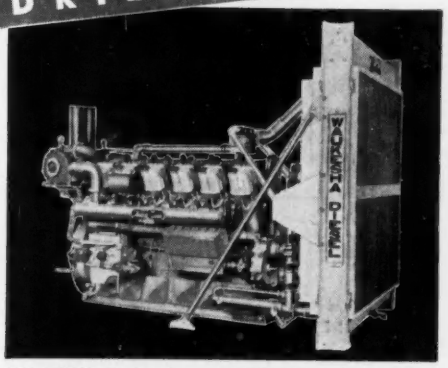
It gives complete line of Waukesha Oil Field Engines for gas, gasoline, normal Diesel, or turbocharged Diesel operation—to 1135 hp.



WAUKESHA MOTOR COMPANY
WAUKESHA, WISCONSIN
New York • Tulsa
Los Angeles

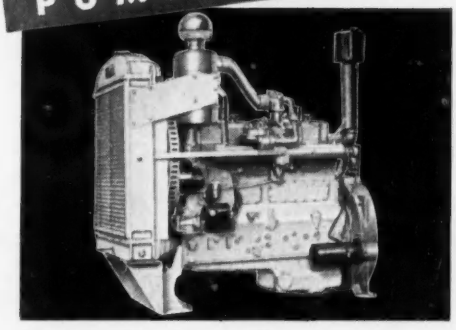
253-R

DRILLING



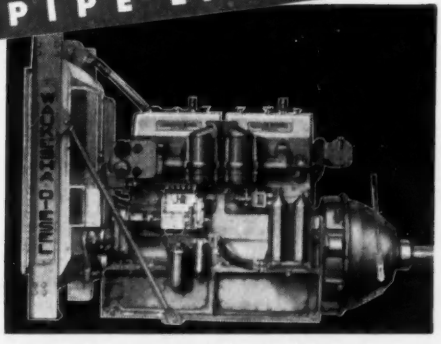
VLRDBSU Turbocharged Diesel Unit—twelve cyl., 8½-in. bore x 8½-in. stroke, 5788 cu. in. displacement, 1100 hp at 1200 rpm, maximum.

PUMPING



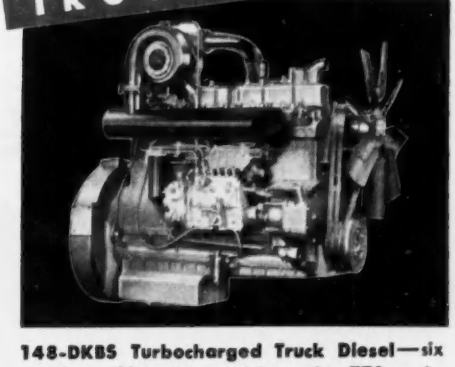
145-GZBU Gas Power Unit—six cylinders, 5⅜-in. bore x 6-in. stroke, 817 cu. in. displacement, 176 hp at 2000 rpm on natural gas.

PIPE LINE



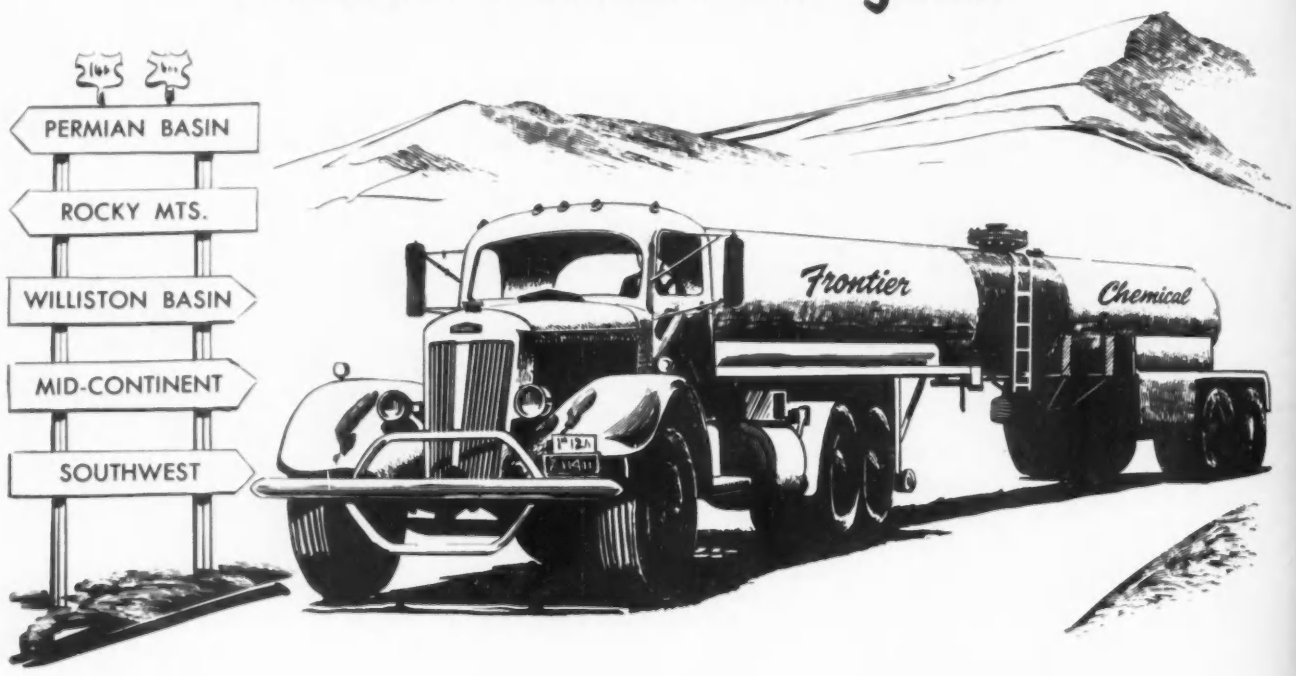
NKDBU Normal Diesel Power Unit—six cylinders, 7-in. bore x 8¼-in. stroke, 1905 cu. in. displacement, 274 hp at 1200 rpm, maximum.

TRUCKING



148-DKBS Turbocharged Truck Diesel—six cylinders, 5¼-in. bore x 6-in. stroke, 779 cu. in. displacement, 280 hp at 2100 rpm.

wherever you are...
Frontier delivers the goods



GEARED TO SERVE THE OIL INDUSTRY

with plants at

DENVER CITY, TEXAS

WICHITA, KANSAS

AND ACID FROM DUMAS, TEXAS

Wherever you're producing or refining . . . in the Permian Basin, Rocky Mountain, Williston, Mid-Continent or Southwest . . . Frontier delivers your basic chemicals *on schedule.* Frontier's handy plant locations save transportation time and costs. Frontier quality meets your specifications. And Frontier truck-trailer and tank-car service delivers the goods . . . dependably.

CAUSTIC SODA (liquid, flake, solid) • MURIATIC ACID • CHLORINE

99% PURE SALT (fine grain for drilling mud; briquette for process uses)

PERMIAN BASIN OFFICES
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ELECTRO-CHEMICAL
Frontier Chemical Company
MANUFACTURERS

GENERAL OFFICES
WICHITA, KANSAS

DIVISION OF UNION CHEMICAL & MATERIALS CORPORATION

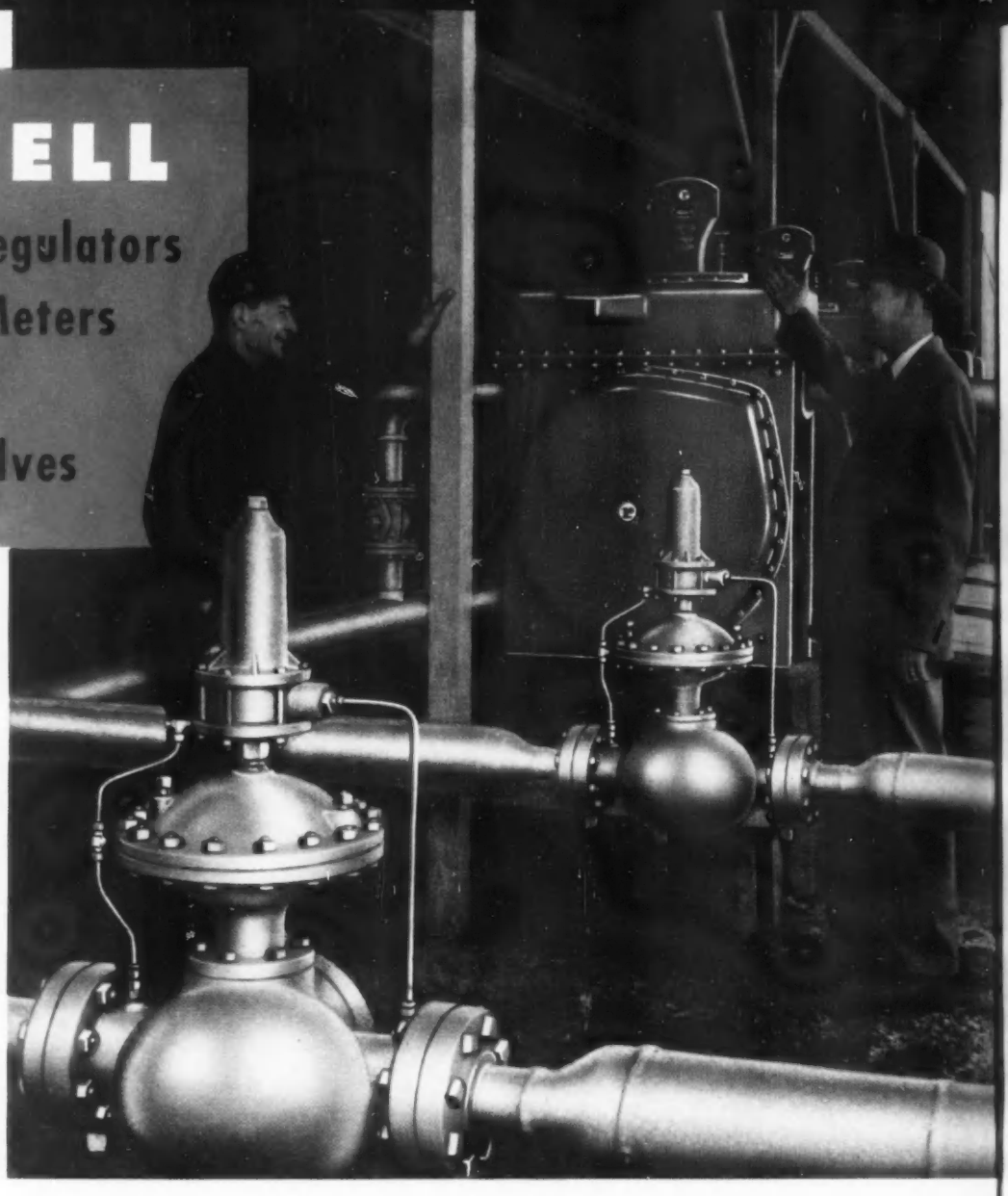
IT FIGURES BEST!

This No. 4 Rockwell meter has a mechanical brain. It's fitted with a Rockwell Emcorector gauge. The Emcorector accurately converts the volume of gas measured at high, variable pressures to a corrected constant base pressure volume for billing purposes. The total appears directly on a straight reading counter. No calculations are required. Here's another way Rockwell metering earns money, saves time and effort for gas utilities.

Rockwell Large Capacity Meter with Emcorector

ROCKWELL

"015" Pressure Regulators
Pressed Steel Meters
Nordstrom
Lubricated Valves



MAKE BIG B.T.U. BINS BEHAVE!

Getting the maximum in revenue at lowest cost per cubic foot measured is yours when you entrust your big jobs to Rockwell meters, regulators and Rockwell-Nordstrom valves. For many years these better-built products have enjoyed an ever increasing measure of gas industry acceptance. Their accuracy and dependability have been proved by time, their low servicing costs are a matter of record. Next time why don't you go Rockwell all the way? Learn the economies of dealing with one reliable source and having but one responsibility for your complete satisfaction.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA. Atlanta Boston Chicago Dallas Houston Kansas City, Mo. Los Angeles New York Philadelphia Pittsburgh San Francisco Seattle Tulsa

In Canada: Peacock Brothers Limited

SQUEEZED FOR SPACE?

If limited floor space poses an installation problem consider these advantages. Both Rockwell Pressed Steel meters and "015" Pilot Loaded regulators go up in the air. They frequently save valuable ground space. You can manifold them in less area than other designs. Too, Rockwell-Nordstrom valves are most compactly designed—instantly respond to quick, quarter turn operation.

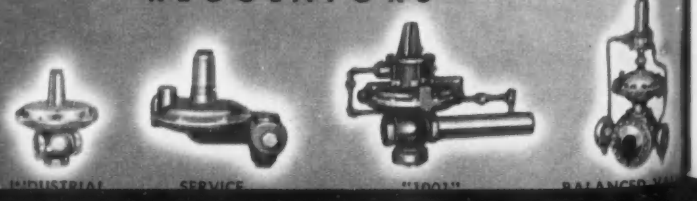
YOU CAN RELY ROCKWELL ON ROCKWELL

There's a ROCKWELL METER and REGULATOR for every use

METERS

TIN ALUMINUM CAST IRON PRESSED STEEL

REGULATORS



INDUSTRIAL SERVICE "1001" BALANCED

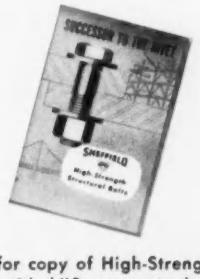
Sheffield bolts beat big league baseball deadline

Structurals of Kansas City's Major League Stadium were bolted together in record time.

When Kansas City acquired the American League franchise from Philadelphia last November, the old city ballpark had to be rebuilt to major league standards in time for the new Kansas City Athletics opening game April 12. It was done, thanks in no small part to the speed and ease of installation of Sheffield High-Strength Structural Bolts.

Two men can fit and tighten approximately 400 bolts in a working day, compared with 300 to 350 rivets for average *four-man* riveting crew.

The cost of an installed high-strength bolt is estimated by many erectors at 50¢ as against 80¢ for a rivet. Sheffield High-Strength Bolts, because of their greater clamping and load strength, add to the life of the structure... stay tight even under vibration caused by thousands of feet stomping in unison.



SHEFFIELD STEEL
DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON KANSAS CITY TULSA

Write for copy of High-Strength Bolt book entitled "Successor to the Rivet."

SHEFFIELD
ARMCO®
High-Strength Structural Bolts

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

SEEING THE UNSEEN!

From Tuboscope research has come a line of new instruments, new techniques, new ways to **see the unseen.** Tuboscope research is closely coordinated with field practice. There are no prima donna instruments to fail and tie up your operation. Tuboscope builds for the oil fields and builds to reduce the unnecessary cost of breakdown in tubular goods.
Tuboscope can be depended on to bring the best in new methods of non-destructive testing of oil field tubular goods.

Tuboscope COMPANY

2400 HOLMES ROAD • HOUSTON, TEXAS

serving you with 22 stores and 11 regional offices in 5 states

You can rely on US *United Supply*

UNITED SUPPLY

UNITED SUPPLY
AND *Manufacturing* COMPANY
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TULSA, OKLA. phone 4-5154
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PAULS VALLEY, OKLA. phone 1080
SEMINOLE, OKLA. phone 1665
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GREAT BEND, KAN. phones 3506 - 7579
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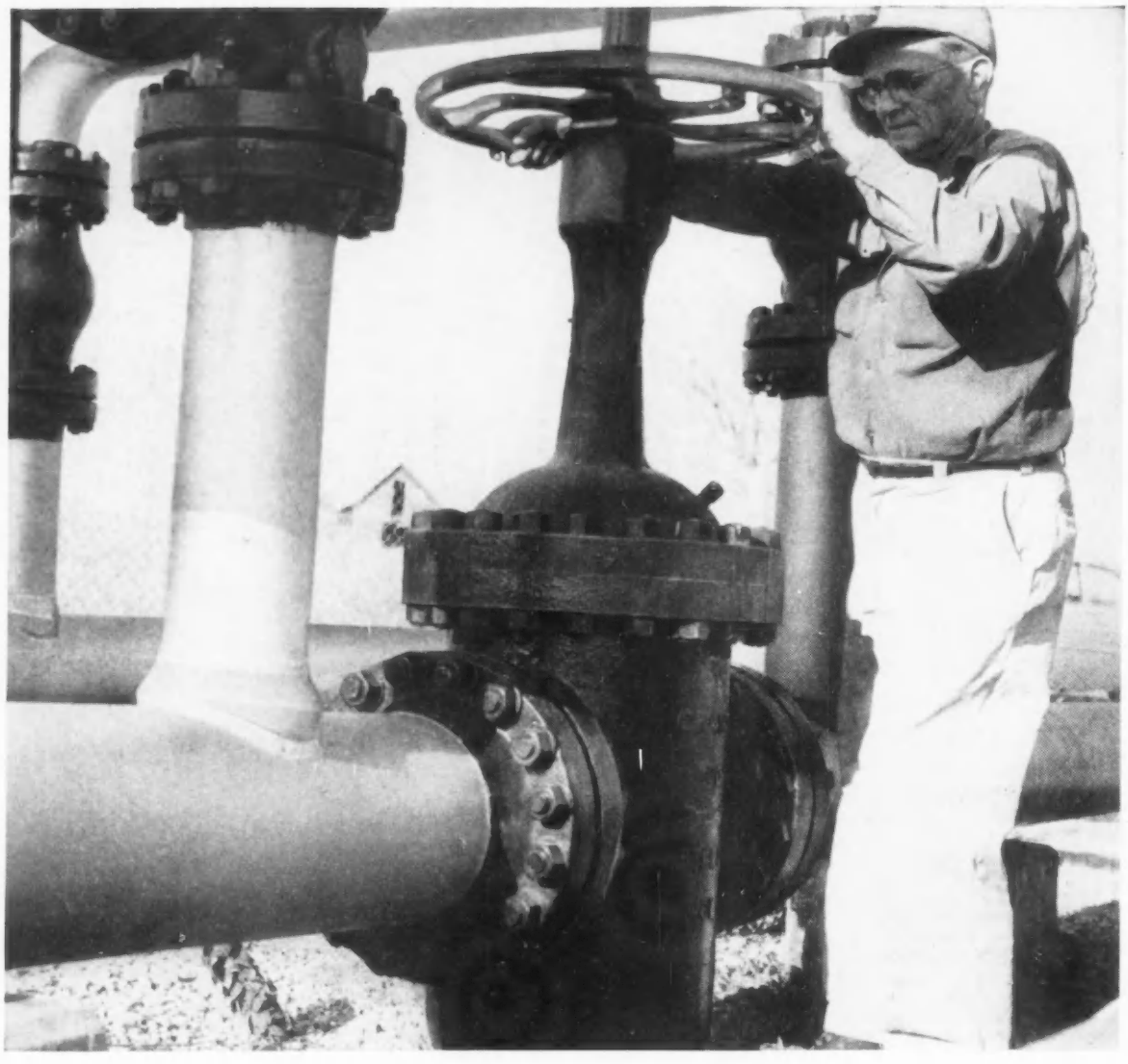
NEW ORLEANS, LA. phone Magnolia 3781

COURTESY ● SERVICE ● DEPENDABILITY



Easy does it...year after year with this Crane pipe-line valve

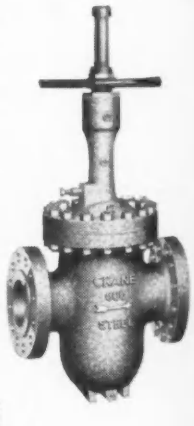
THE CASE HISTORY—More than 3 years ago the Phillips Pipe Line Co. installed this Crane conduit valve in a junction manifold on its 10-inch crude line to Borger, from Yale Station, Oklahoma. How's it doing?

Operated every day or two until a few months ago, this Crane double-seating, grease-packed valve has always responded smoothly and easily to the handwheel—never sticking. Under former frequent usage as now with infrequent operation, it has never leaked at the bonnet joint or packing chamber—remains tight as new at the seats. This Crane valve—because its pressurized stuffing box eliminates leakage—is clean, unstained.

On gas and oil, these Crane valves are making big savings in operating costs. They're the leading value for pipe line service, and thrifty buyers know it. Crane Co., General Offices, Chicago 5, Illinois. Branches and Wholesalers in all industrial areas.

CLASS 600 STEEL PIPE-LINE GATE VALVES

Grease packing in body and bonnet assures thorough internal lubrication for easy operation. Parallel disc design gives tight closure; eliminates seat leakage. Spring plates in contact with disc faces keep foreign matter out of body. When open, conduit ports through disc give straight-line, unrestricted flow. Full-way or Venturi patterns; sizes 2 to 30 in. Literature sent by mail, or ask your Crane Representative.



CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

NEW

MID-CONTINENT SUPPLY CO.
Exclusive Oil Field Distributors
—Domestic and Export

VERY
HIGH
STRENGTH

15% STRONGER
THAN IMPROVED PLOW STEEL

SIZE FOR SIZE the new VHS wire rope developed by American Chain & Cable Company is at least 15% stronger than Improved Plow Steel, which has been the standard grade of the wire rope industry.

FOR DEEPER DRILLING the extra strength of Tru-Lay VHS provides additional weight lifting capacity in the same diameter of wire rope.

LONGER LIFE MEANS LESS COST The ability of VHS to withstand shock and abrasion to a greater degree than any other grade means a longer lasting rope.

Available NOW through all Mid-Continent Stores

PESA
PARTNERS IN PETROLEUM PROGRESS

ACCO
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Product of
American Cable
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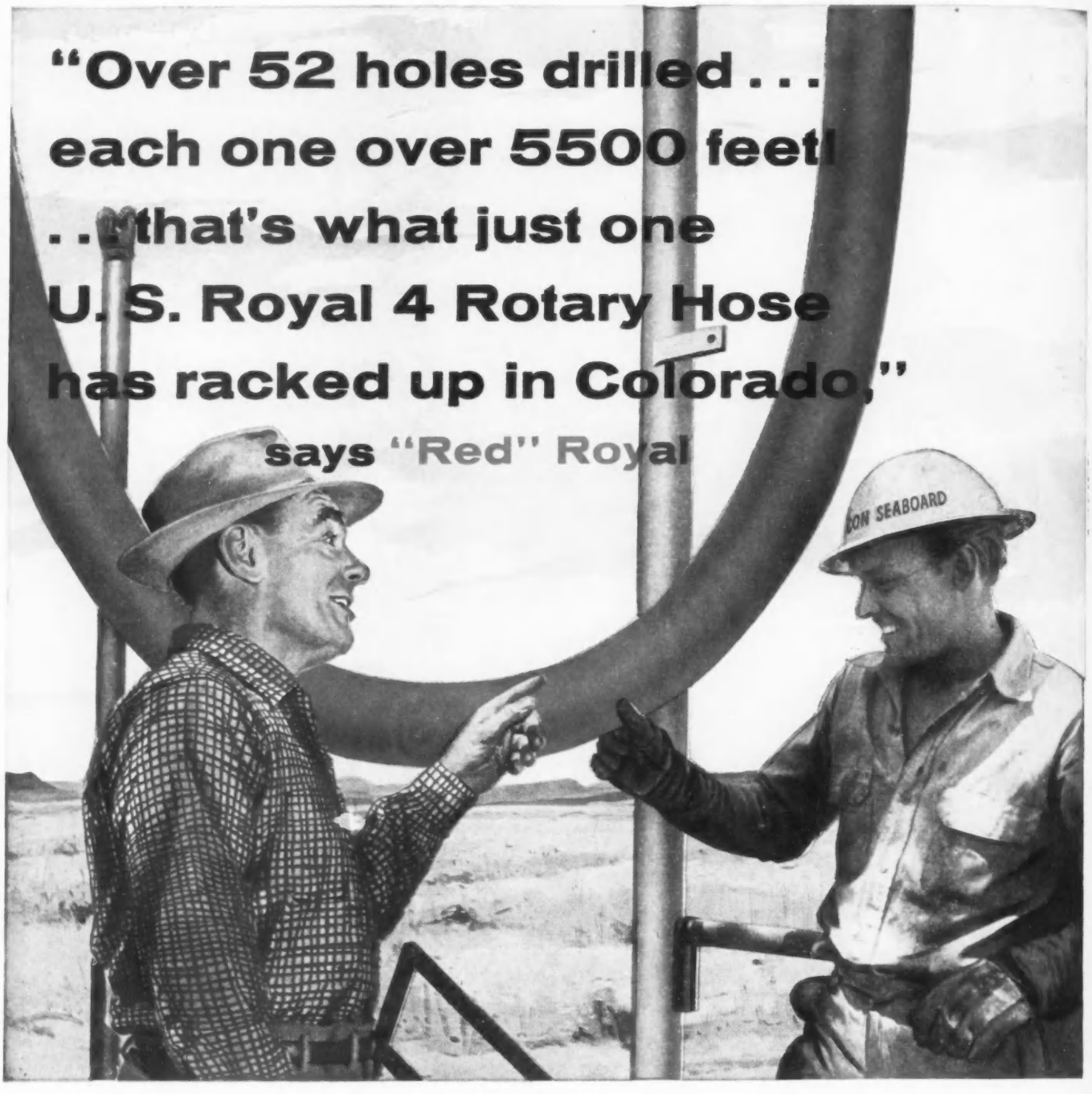
Supply Company
MID-CONTINENT BLDG. FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY


"Over 52 holes drilled . . .
each one over 5500 feet!
. . . that's what just one
U. S. Royal 4 Rotary Hose
has racked up in Colorado,"
says "Red" Royal
FALCON SEABOARD

"Red" Royal knows the story well. His friends, Zack Taylor (drilling superintendent) and Bud Swain (driller) of Falcon-Seaboard Drilling Co., handled these jobs. The U. S. Royal 4 Rotary Hose (Serial No. 1-250) was put in service in July, 1951, and is still on the job today, *four years later.*

You can bet that "Red" Royal would never be caught buying inferior hose that wastes his drilling dollars. Experience after experience, in field after field, demonstrates that no hose can match the service records piled up by U. S. Royal 4. It's the hose that handles the highest pressures on today's pumps—it's used all the way from spud to pay.

Developed by Science—Proved by Drillers

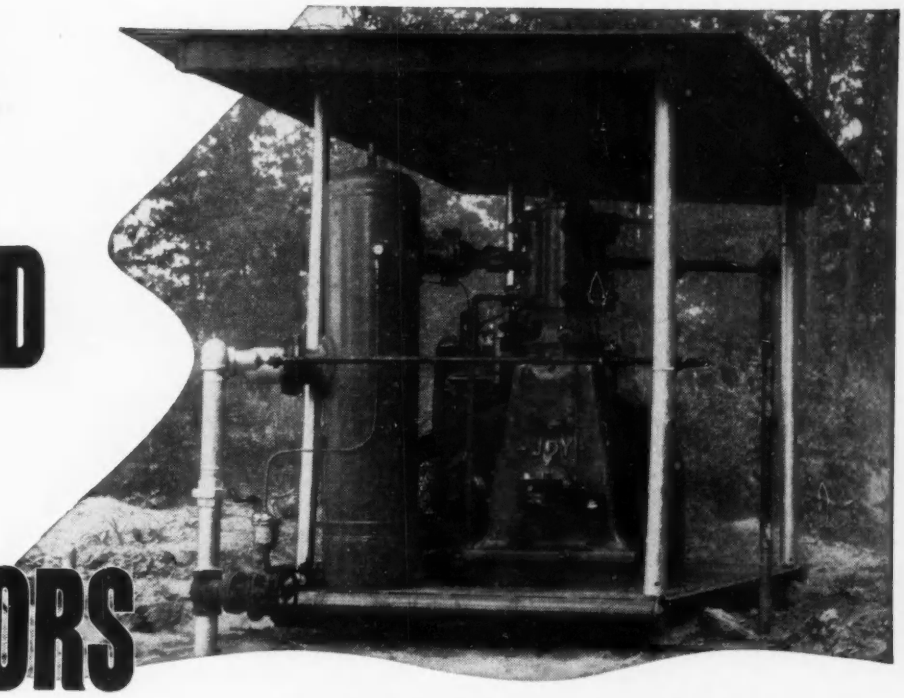
Available in all fields at supply stores

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER · NEW YORK 20, N. Y.

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

JOY PACKAGED GAS COMPRESSORS

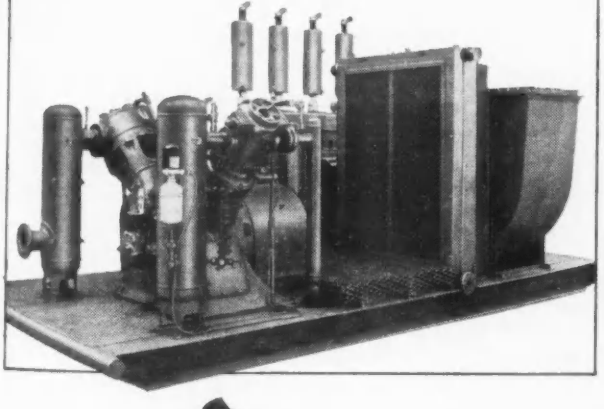


JOY CLASS WGB-110 GAS COMPRESSOR:
Inlet pressure—50 Psig., Discharge Pressure—200 Psig., Capacity—.5 MMCFD.

the only modern-design compressors for gas booster operation

No other gas compressors available today for booster service were designed as recently as the Joy Packaged Units, and offer as many modern advancements in design for field-proved economy and efficiency.

JOY CLASS WNB-112 GAS COMPRESSOR:
Inlet pressure—20 Psig., Discharge Pressure—650 Psig., Capacity—.8 MMCFD.



Best of all, these modern Joy Compressors are backed by a century-old reputation for low maintenance and long, uninterrupted operation. They are the most reliable you can put on the job for gas gathering, repressuring, or gas lifting . . . *because of these time-proved features:*

1. Field-replaceable cylinder liners.
2. Field-replaceable crosshead guides.
3. Patented Joy "Dual-Cushion" valves.
4. Full force-feed lubrication.
5. Anti-friction main bearings.

Available in vertical, V-type, and semi-radial designs for minimum space requirements, Joy gas compressors may be single- or two-stage units with cylinder sizes ranging from 3" to 13½". Four different frame types are available for a range from 50 to 400 H.P.

Your Joy representative can specify the most efficient compressor for your needs. Call him or write for Bulletin A-94. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

W&D I 5469

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

Batting .600 in the Repeat Order League

In big league competition, three out of every five Bucyrus-Erie spudders sold go to customers who have used these outstanding rigs before — a truly remarkable success story in itself. The reasons behind the story are even more important.

BIG CAPACITY Each model has plenty of capacity for its range. For instance, the big 48-L swings up to 6,000 pounds of tools, drills top-to-bottom to 6,000 feet. For heavier work, this rig is available with a heavy-duty Tripod Derrick which permits handling static casing loads up to 300,000 pounds.

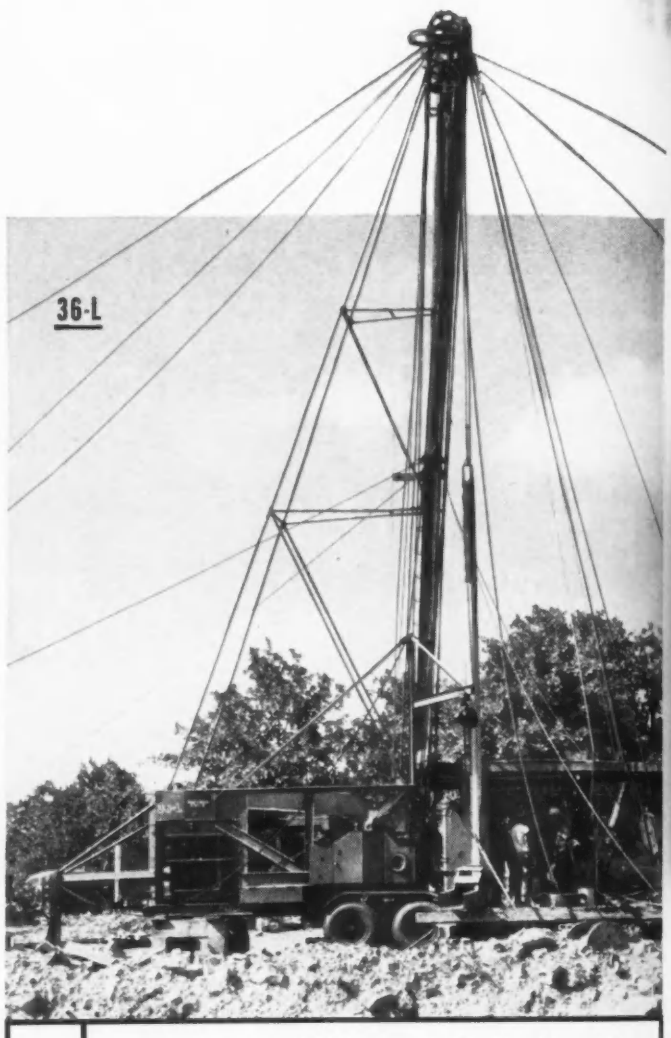
VERSATILITY With each Bucyrus-Erie model, you can handle top-to-bottom drilling, deepening, drilling-in, workover, tube-and-rod servicing, swabbing, cleanout, etc.

MOBILITY Bucyrus-Erie spudders are particularly noted for fast moves and quick setups. Readying a rig for operation is a matter of hours, not days. You cut lost time to minimum.

LONG LIFE Drilling machinery is held in alignment by an all-steel, electric welded, fully trussed box frame. You get long-life performance . . . low maintenance requirements at minimum cost.

For complete information, see your local Bucyrus-Erie spudder distributor. With all the facts at hand, you'll know why those who use 'em, choose 'em again.

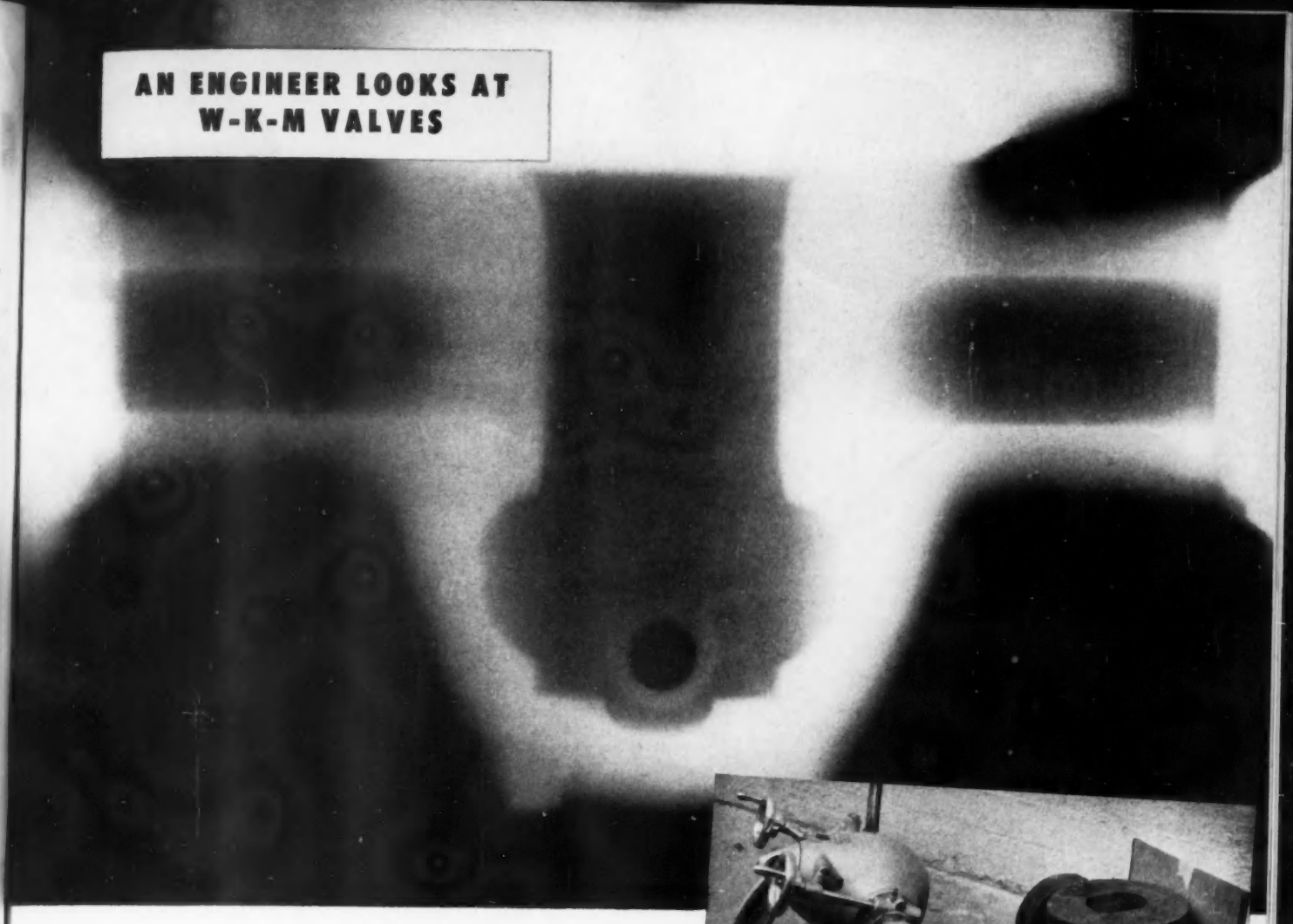
22555



60-L	Top-to-bottom drilling to 1,500 ft.; Servicing to 2,000 ft.; Swings up to 2,750 lbs. of tools.
28-L	Top-to-bottom drilling to 2,500 ft.; Servicing to 3,000 ft.; Swings up to 3,000 lbs. of tools.
36-L	Top-to-bottom drilling to 3,500 ft.; Servicing to 4,000 ft.; Swings up to 4,200 lbs. of tools.
48-L	Top-to-bottom drilling to 6,000 ft.; Servicing to 7,000 ft.; Swings up to 6,000 lbs. of tools.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

AN ENGINEER LOOKS AT W-K-M VALVES



On Gamma Ray Inspection

Careful gamma-ray inspection by an expert will reveal the following defects in light or heavy-section steel: gas and blowholes, sand spots and inclusions, internal shrinkage, hot tears, cracks, unfused chaplets, internal chills.

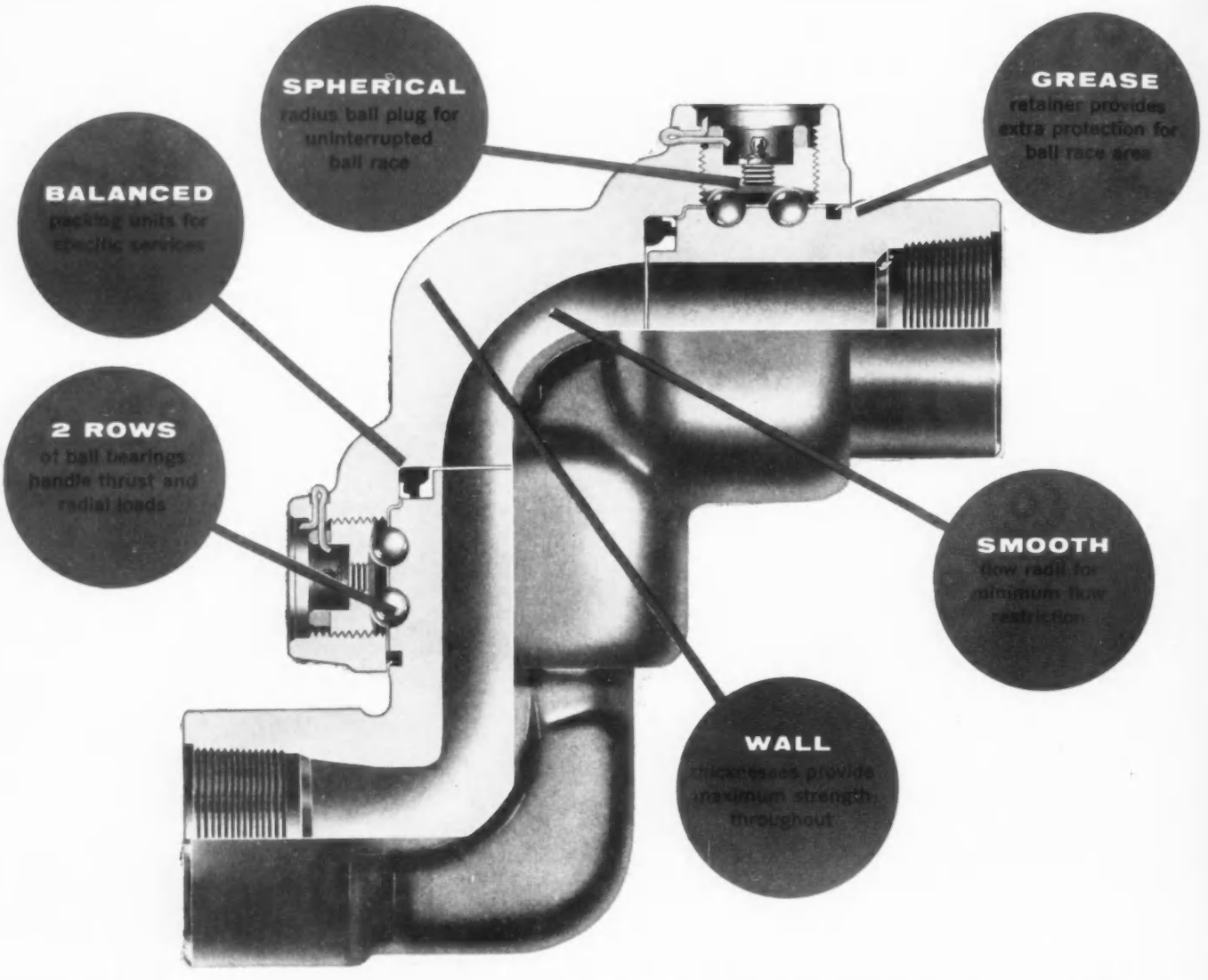
While the radiographic films mean little to the uninitiated, one familiar with them can spot defects to within 2% or less of the wall thickness. For example, if the total wall thickness should measure 2", it is possible to locate a blowhole or inclusion only .04" or less in diameter.

W-K-M uses gamma-ray inspection on the W-K-M 10,000—15,000 p.s.i. test valves. They are inspected according to the procedure outlined in the ASTM Spec. E 71-47T. When you specify valves for any high pressure service, be sure to remember that W-K-M high pressure valves are the soundest, safest buy in the field.

Top: W-K-M 2", 15,000 p.s.i. Steel Valve. Notice how lettering on the body and foundry mark (right) show up. The rectangle below the top hole is a penetrameter, a steel leaf (.05" thick) taped to the body to show the penetration of the gamma rays.
Bottom: The gamma ray "camera" contains 5000 millicuries of Cobalt 60, capable of penetrating 6" steel in 3.5 hours.

W-K-M Valves

W-K-M MANUFACTURING COMPANY, INC.
A SUBSIDIARY OF acf INDUSTRIES INCORPORATED
P. O. Box 2117, Houston 1, Texas Los Angeles, California
Export Office: 45 Rockefeller Plaza, New York, N. Y.



precision engineered for your service

CHIKSAN Ball-Bearing Swivel Joints are precision engineered like a fine watch to give unlimited flexibility and unlimited service in the conduct of fluids, gases and liquids.

CHIKSAN is the originator and largest exclusive manufacturer of ball-bearing swivel joints in the world today.

CHIKSAN produces packing designs for specific service requirements, assuring constant torque at any given pressure.

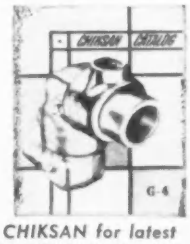
CHIKSAN has acquired a world-wide recognition for highest quality of product and lowest maintenance costs.

CHIKSAN has over a quarter of a century of "know-how" in the design, manufacture and successful scientific application of ball-bearing swivel joints in industry.

CHIKSAN offers the widest range of styles, sizes and pressures available for every major industrial use today.

CHIKSAN has complete nation-wide coverage of its products and applications by qualified field service engineers.

CHIKSAN will custom engineer for you the solution to any problems involving the transport of fluids, gases and liquids.



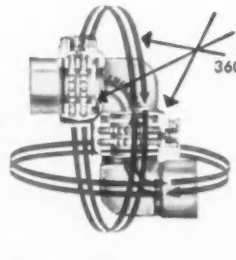
Write CHIKSAN for latest INDUSTRIAL CATALOG—G-4
Dept. WO-6

Supply and Service of CHIKSAN Ball-Bearing Swivel Joints is always as near as your telephone.

The Flow of Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints



CHIKSAN Ball Bearing Swivel Joints are THE NEW TOOL of Modern Industry with full 360° rotation in 1, 2, and 3 planes. Over 1,000 different types, styles, and sizes have been developed for pressures and services from 28" vacuum to 15,000 psi and for temperature ranges from minus 70° to a plus 500° F. with packing materials for each specific service.

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 3, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Co., Brea, Calif.; Newark 2, N. J. • Chiksan of Canada Ltd., Edmonton, Alta.

NO TELESCOPE... NO SLIP!

VISKON

New Plastic Flagging Tape

"STAYS PUT" ON ROLL!

• Yes, new VISKON plastic flagging tape is far easier to handle—it stays on the roll until *you* unwind it! Won't rope, and is very easy to tie. NON-TOXIC, too! Completely harmless to range or farm animals. Very light weight—the handy compact roll can either be carried in your pocket, or looped on your belt.

Old Favorite Viskon Rayon Fabric!

If you prefer cloth flagging tape—VISKON has it. Easy to tie; non-toxic; in handy rolls to loop on your belt. You can write on it with either pen or pencil. Won't rope or slip on the roll.

5 Brilliant No-Fade Colors!

Plastic or fabric, VISKON Flagging Tapes are available in the highly visible brilliant colors RED, ORANGE, BLUE, YELLOW, WHITE. These colors are fast to sunlight and rain.

VISKON®
FLAGGING TAPES
Another fine product for Modern Industry by
THE VISKING CORPORATION

DISTRIBUTED BY
LEW WENZEL & COMPANY
319 E. 4th St., Tulsa, Oklahoma

THE VISKING CORPORATION
North Little Rock, Box 72, Arkansas. Dept. WO-6-55

Please send samples and prices of your plastic and fabric flagging tapes.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

My supplier is_____

The maker of this pump hasn't said "just put on a gauge"...
The maker of this pump has refused to place his *good* product at the mercy of a *poor* gauge. He has equipped it with the best pressure gauge that money can buy: a Marsh.
You can ask for no better proof that he is trying to give you the best all the way through . . . and this applies to the manufacturers of all gauge-equipped products.
MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corp.
Dept. K, Skokie, Ill.
Houston Branch Plant:
1121 Rothwell St., Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd.,
8407 103rd Street, Edmonton, Alberta, Canada
The JAS. P. MARSH Corporation
SKOKIE, ILLINOIS
90th ANNIVERSARY YEAR
1865 - 1955
MARSH GAUGES
"THE STANDARD OF ACCURACY"

How much Is your annual bill for drilling lines?

HOW TO STOP A LEAK

You don't buy drilling lines with petty cash. Wire rope costs the drilling industry millions annually . . . one reliable estimate is $100,000 a day!

The heavy end of this million-dollar burden is carried by rotary and cable tool men using conventional lines.

Wire rope can be less expendable. Let us tell you briefly about SpringKore and PlastiKore.

The heart of a SpringKore rotary drilling line is a tightly coiled steel spring, packed with lubricant against rust and wear.

The high-carbon cold-drawn steel spring center will flex without crushing. You get a uniform line that stays that way under very trying conditions.

With a SpringKore line you can operate with a confidence you never felt before.

PlastiKore cable tool drilling lines have a polyvinyl center that is permanently firm and flexible.

It guards against internal corrosion—absorbs no moisture.

Even acids do not affect it.

You get a uniform line with a tough, firm center that never pulls down.

Ask any J&L man for a list of drillers in your area who have stopped a major maintenance leak with SpringKore or PlastiKore.

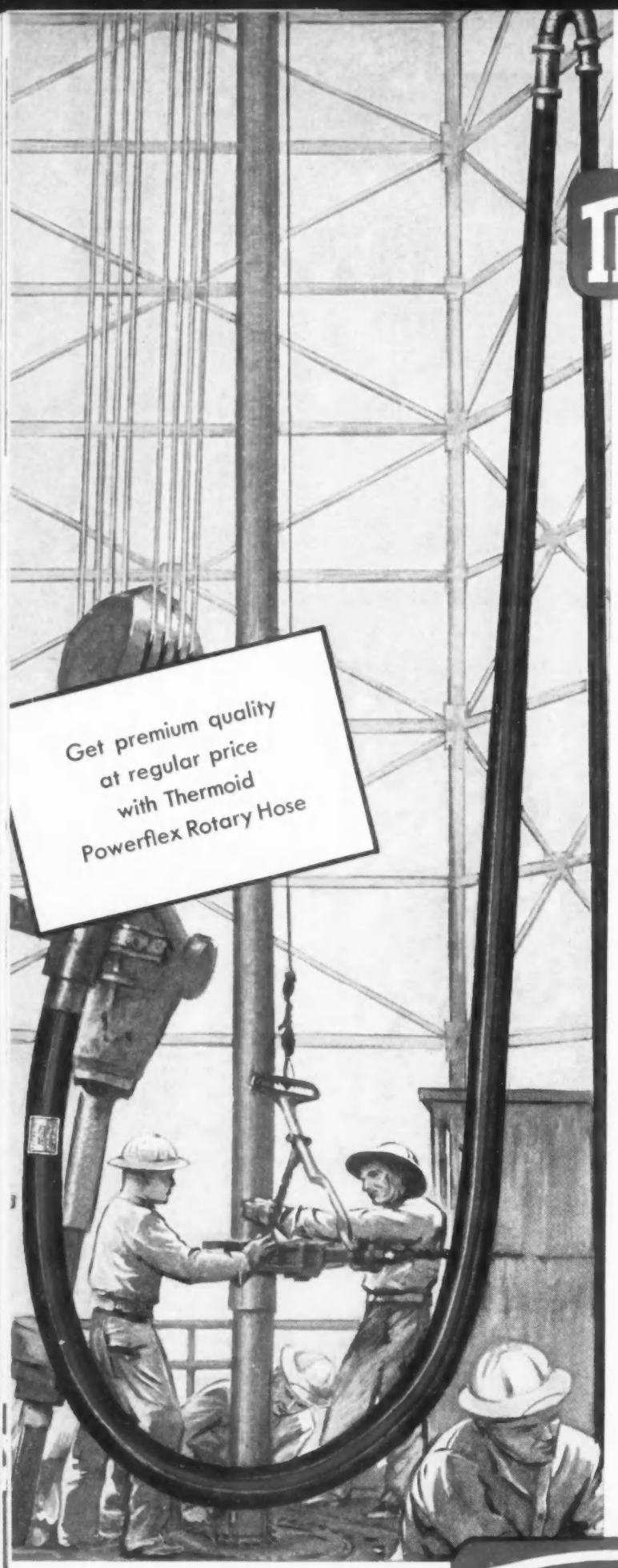
J&L STEEL

P·E·S·A PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION — PARTNERS IN PETROLEUM PROGRESS

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION – TULSA, OKLAHOMA
Serving The United States and Canada

104-S

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)



Thermoid

POWERFLEX Rotary Hose

. . . the most widely imitated Hose in the oil field!

None have been able to fully match the strength and flexibility of Thermoid Powerflex Rotary Hose.

Powerflex is made of oil-and-abrasion-resistant synthetic rubber, reinforced with impregnated multi-ply woven fabric and high tensile steel cable. Its tough, extra-heavy cover resists weather and abrasion. The materials used in Powerflex are available to any hose manufacturer. But it's the way Thermoid wraps and couples Powerflex Hose that prevents duplication.

Patented full-flow couplings are an integral part of each cable, permanently secured before the hose is wrapped. They are guaranteed and leak-proof . . . positively cannot blow off. Every length is pre-tested to 5,000 psi . . . exceeds all API requirements.

For heavy duty service, always demand Thermoid Powerflex Rotary Hose . . . available in all standard sizes and lengths. Order Powerflex and other Thermoid Oil Field Products listed below, from your nearest supply store or from one of the Thermoid warehouses listed in:

Houston, Texas
Oklahoma City, Okla.
Nephi, Utah
Casper, Wyoming
Los Angeles, Cal.

Thermoid

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

Thermoid Company • Offices & Factories: Trenton, N. J. Nephi, Utah

Oil well operators well know the benefits of using Chicago Pneumatic Three Cone Rock Bits. For with deep penetrating action and fast cutting speeds, they not only drill more feet per day but afford tops in durability and dependability as well. CP Three Cone Rock Bits are available in seven different types for all kinds of formations, from soft to exceedingly hard and abrasive. Write for information,
Oil Tool Division, Chicago Pneumatic Tool Company, 5000 U. S. Highway 81 South, Fort Worth, Texas.

Chicago Pneumatic

GENERAL OFFICES: **8 East 44th Street, New York 17, N. Y.**

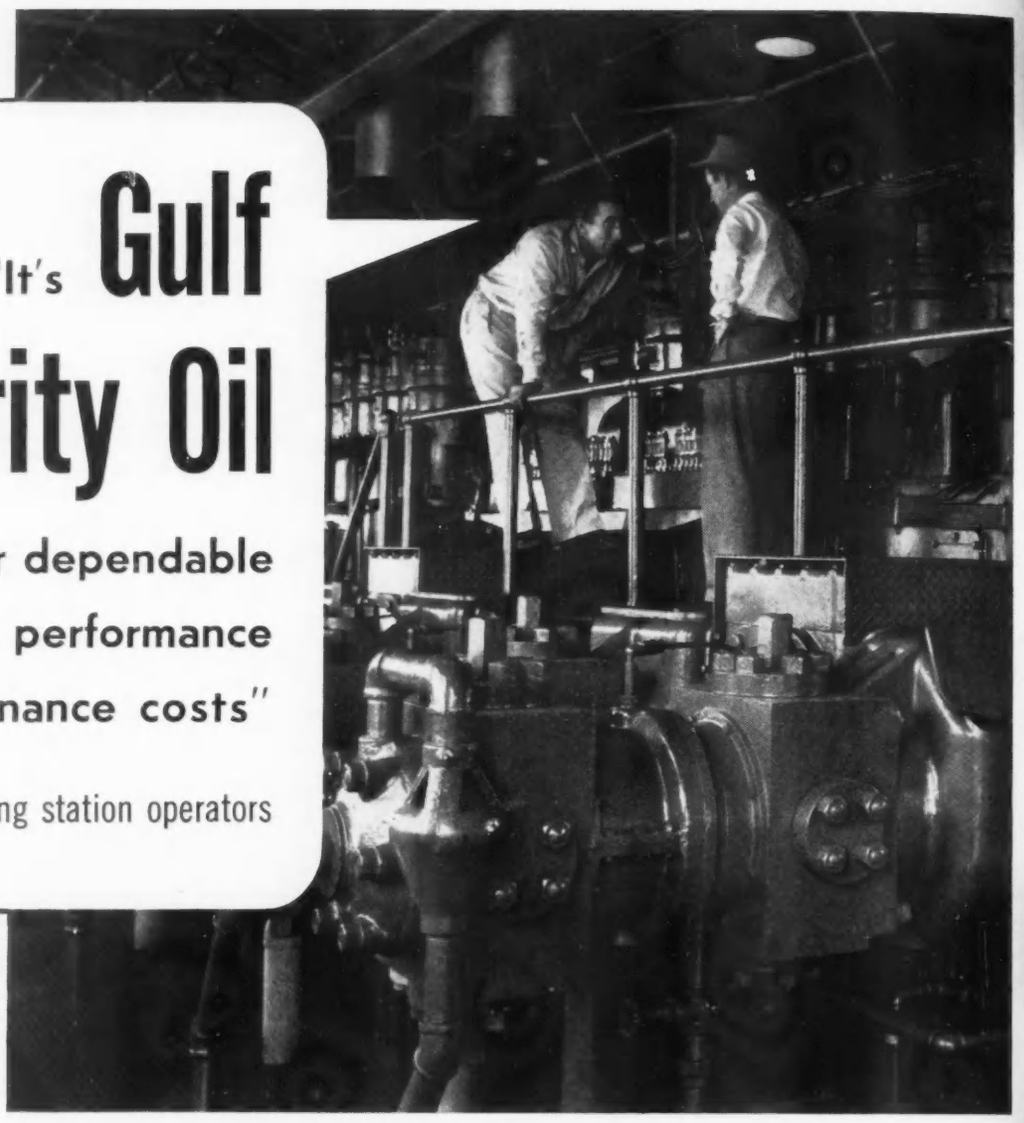
IN CANADA: 10103 81st Ave., So. Edmonton, Alberta, Canada
IN MEXICO: D. R., Rosas Moreno No. 41, Mexico City, D. F., Mexico
PETROLEUM MACHINERY CORPORATION: 30 Rockefeller Plaza, New York 20, N. Y (Export agent, exclusive of Mexico and Canada)

"It's **Gulf**

Security Oil

for dependable
gas compressor performance
and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company
1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF

The finest petroleum products for your every need

BREWSTER N-12

RESERVE POWERED FOR DEEPEST DRILLING

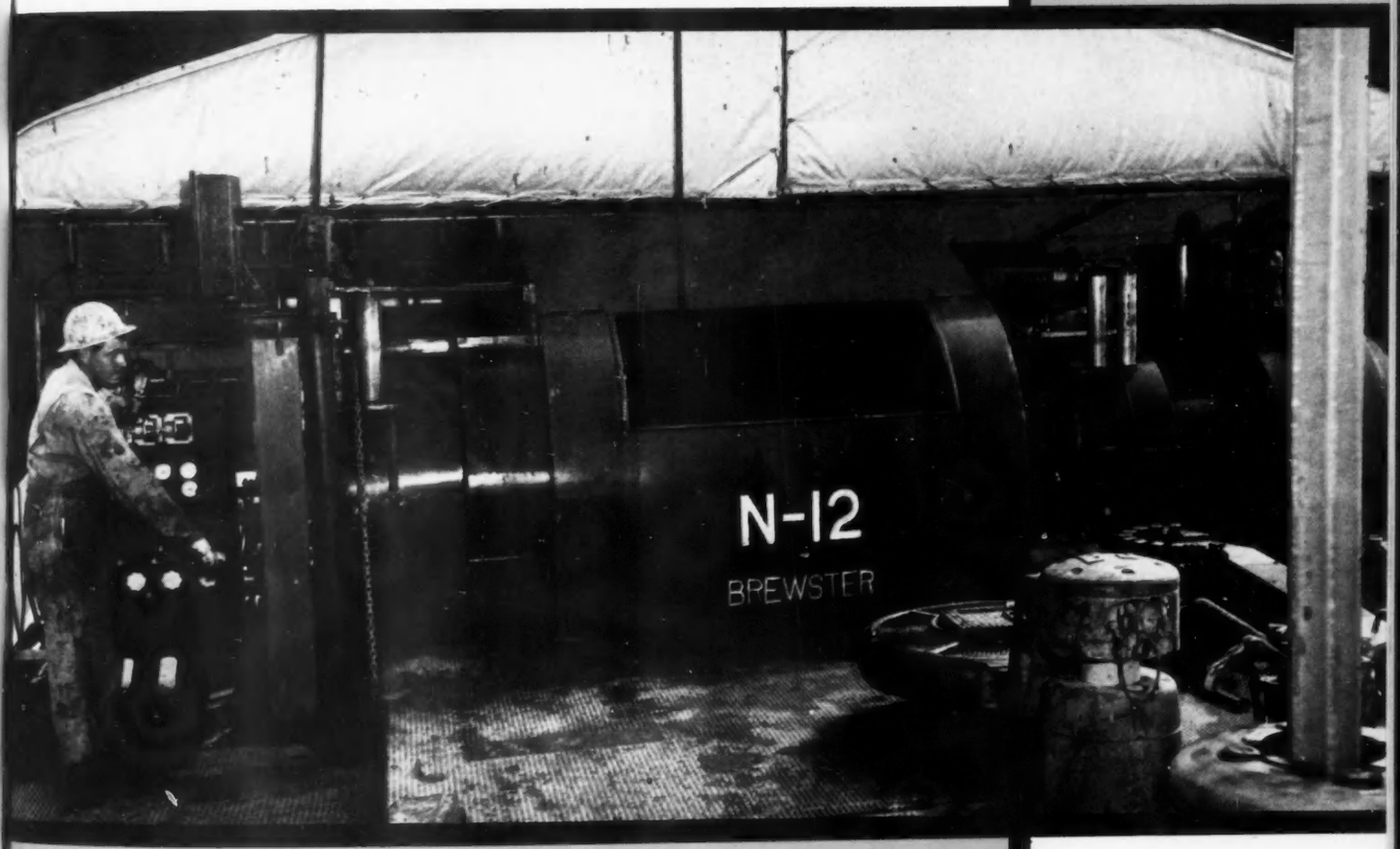
Compact, rugged and responsive, the Brewster N-12 has been specifically engineered to lower deep drilling costs. Every detail from the finger-tip air controls to the heavy-duty box compound and in-line pump drives has been arranged to provide easy handling and maximum portability. The driller can select from any one of eight hoisting speeds to match the load. Without stopping he can instantly shift from low to high. The graduated speed transmission furnishes four forward speeds and a reverse to the rotary. Full engine horsepower can be used at the pumps while maintaining low table speeds.

Each Brewster N-12 is individually tailored to fit the particular needs of the purchaser. They can be ordered with three or four engine compounds ... with mechanical, torque converter or fluid coupling engine drives ... for single or multiple level set-up.

Over-the-road moves have been simplified by designing the rig to move in three road sized packages. Only one chain need be removed to separate the compound and drawworks. The control panel is mounted on the main skid and moves as an integral part of the drawworks package. Engines are coupled to the compound by Fawick air clutches which also serve as quick disconnects when rigging down.

Before you buy get all the facts on the Brewster Reserve Power features that reduce drilling cost on every depth well. Write today —

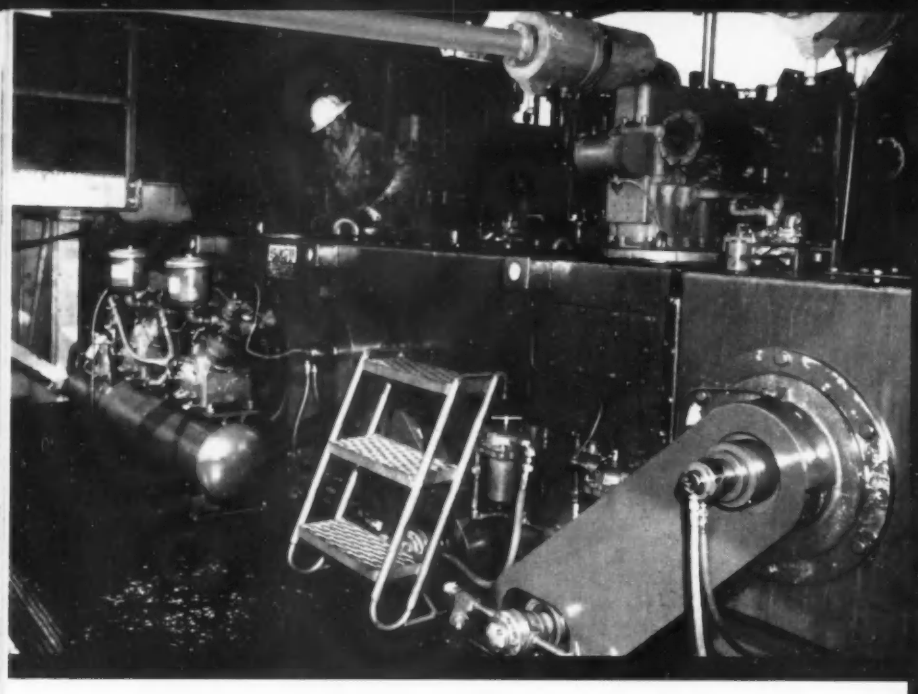
10,000 FT. AND ON DOWN



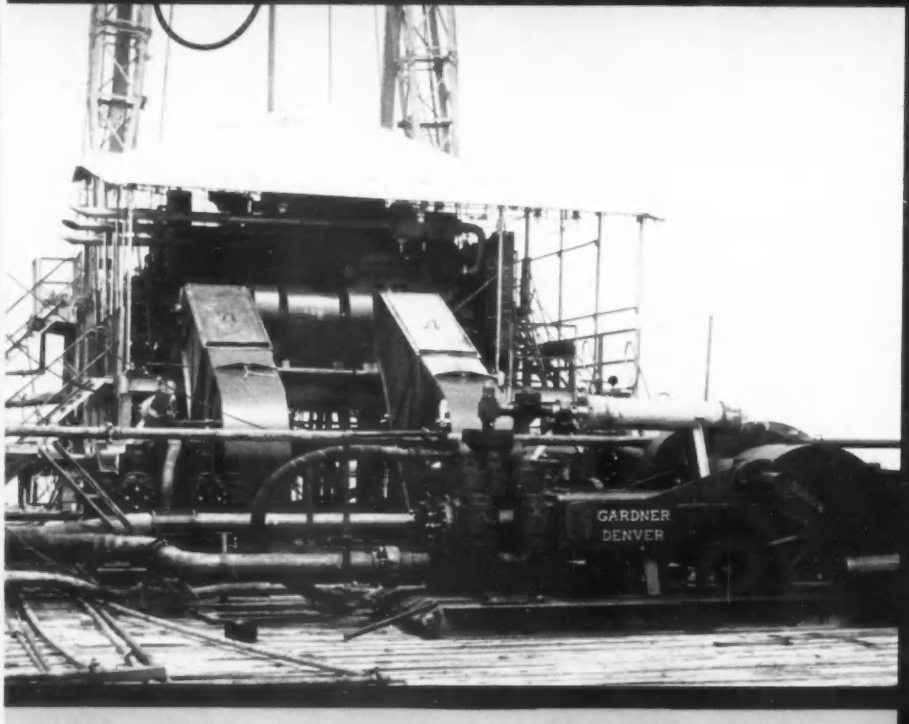
THE BREWSTER COMPANY INC.
SHREVEPORT, LOUISIANA

FOR EVERY DRILLING DEPTH

N-12 DRAWWORKS



BOX TYPE COMPOUND—The heavy duty box-type compound can be furnished for three or four engine drive. Large inspection plates provide easy access to all elements. Bearings and shafts are lubricated by a positive pressure system that uses separately driven oil pumps to assure a constant supply of clean oil.



DUAL PUMP DRIVES—In-line pump drives at the rear of the compound simplify rigging up and manifolding—eliminate the need for idlers or notching the substructure. Individual controls permit them to be used singly or together at the same or different speeds.

BREWSTER N-12

SPEED DIAGRAM

SPEED	LINE SPEED FPM	LINE PULL LBS.
1	359	124,400
2	501	89,300
3	691	64,600
4	953	47,200
5	1,333	33,600
6	1,850	24,300
7	2,578	17,300
8	3,590	12,400

Line speed and pull based on 1500 H.P./83.3 efficiency.

BREWSTER MATCHED EQUIPMENT FOR THE N-12 INCLUDES:

Brewster 500-ton heavy-duty traveling block. Equipped with Timken tapered bearings, available with five or six sheaves grooved to match your crown block.

Brewster 8-S oilbath swivel. High capacity design with tapered main bearing and Brewster's patented "quick change" packing cartridge.

Brewster RSH-22 oilbath rotary table. Completely mud-proof, the RSH-22 is equipped with top and bottom mud seals. Separate lubrication, oil bath for main gear and bearing and alemite for pinion bearings, assures maximum all weather protection.

SUPPLY HOUSES

Howard Supply Company • Apex Equipment Company • Bovaird Supply Company • Industrial Supply Company • Murray Brooks, Inc. • Reams Supply Company

For Canada, Mexico and Export Sales The Brewster Company

THE BREWSTER COMPANY, INC.

We're tipping our hat to line pipe men!

HERE'S A tip of our hat and a thank you to you line pipe men for the confidence you have shown in us.

In the past four years you've demonstrated your confidence in us by ordering more than 24,000 carloads of Basalt-Kaiser steel line pipe for major projects the country over. This is enough to build a pipe line from Juneau, Alaska to the Panama Canal.

It's good to know we've earned this confidence by delivering all of this steel line pipe *on time* . . . and by assuring you *uniform quality* and *prompt service.*

Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Phoenix, Denver, Tulsa, New York

Sargent PUMPS

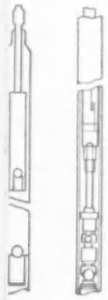
engineered to lift more oil per day at lower costs per barrel

Recognized leader in the development of bottom-hole production pump design, Sargent leads the field in pump engineering, combined with research and manufacturing skill to build pumps that put more oil in your tanks every day, month after month, with minimum maintenance and at lower cost per barrel.

SERVICE Sargent recognizes the importance of pump maintenance and provides the most complete service facilities in the industry. This service is always available through Sargent sales and service stores conveniently located throughout the oil country and staffed by company-trained pump experts.

On the basis of performance and service, Sargent pumps give you more for your money.

Write for complete details.



Sargent, who originated the Insert Rod Sectional Liner Pump, once again offers the latest and best method of pumping oil, through its development of the Sargent Rodless Hydraulic Pump. This pump puts the long stroke unit at the bottom of the well, where it belongs, to operate hydraulically the time-proven standard bottom-hole pump. Rod problems and tubing wear are eliminated. The ultimate in gas compression ratio (elimination of gas lock) is thus obtained with this unit because pump valves are accurately spaced before the pump is run into the well.

Standard Sargent API pump parts facilitate service maintenance of the rodless pump, which can be repaired in any of the Sargent sales and service stores.

SALES & SERVICE

CALIFORNIA
Long Beach
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Standard of Excellence *Since 1920*

Sargent

ENGINEERING CORPORATION

2533 East 56th Street
Huntington Park, California

• "GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.
U. S. Supreme Court

BUILDS PUMPS THAT BUILD GOOD WILL

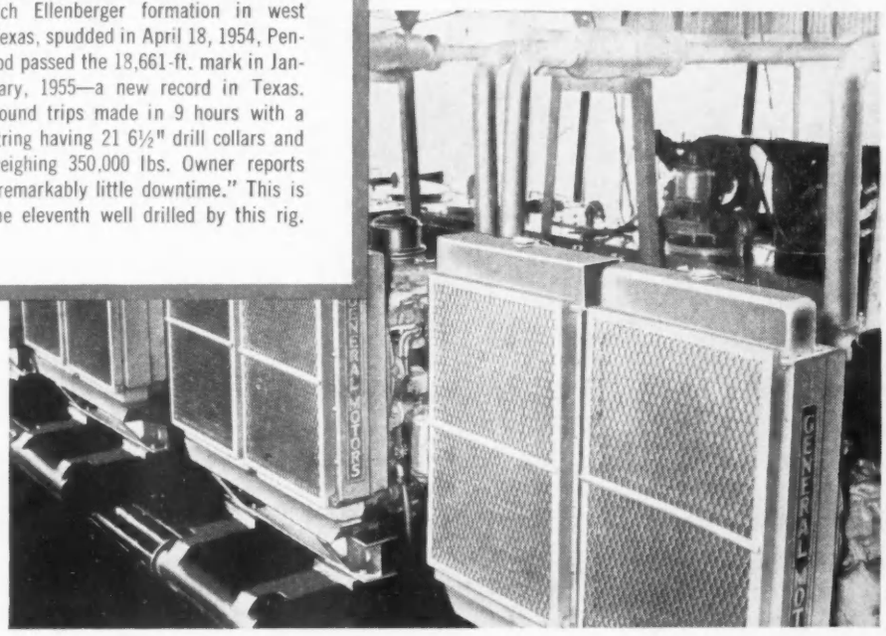
GM DIESEL
CASE HISTORY No. ID2-11

OWNER: Penrod Drilling Company, Shreveport, La.

INSTALLATION: 4 GM Twin "6-71" engines powering Brewster N-12 1500-horsepower "golden rig," with Lee C. Moore jackknife mast and two Wilson-Snyder 20" mud pumps.

PERFORMANCE: In deep-well test of rich Ellenberger formation in west Texas, spudded in April 18, 1954, Penrod passed the 18,661-ft. mark in January, 1955—a new record in Texas. Round trips made in 9 hours with a string having 21 6½" drill collars and weighing 350,000 lbs. Owner reports "remarkably little downtime." This is the eleventh well drilled by this rig.

Texas Depth Record Broken by GM Diesel-Powered Rig



DEWEY DAVIS, drilling superintendent for Penrod, will tell you it takes the *right* equipment, *good* crew work and *dependable* power to achieve a deep-well record like this.

And for big rigs that combine operating economy with portability, General Motors Diesel power is your best choice. Here are five reasons why:

1 **Low first cost**—as a result of General Motors' famous mass-production methods.

2 **Low fuel consumption**—unit injectors and blower scavenging mean more power from each gallon of fuel.

3 **Faster trips**—two-cycle design with power on every piston downstroke makes GM Diesel engines faster-accelerating.

4 **Quicker moves**—GM Diesels are more compact and weigh less than 4-cycle Diesels of comparable power rating.

5 **Service and parts availability**—no matter what out-of-the-way location you drill in, GM Diesel parts and service are never far away.

Want to make hole at less cost? Ask your General Motors Diesel distributor for a free power survey, or write direct to us.

DETROIT DIESEL ENGINE DIVISION

GENERAL MOTORS • DETROIT 28, MICHIGAN

Single Engines . . . 30 to 300 H. P. Multiple Units. . . Up to 893 H. P.

GM GENERAL MOTORS DIESEL POWER

GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 PHILTOWER BLDG., TULSA, OKLAHOMA

ALABAMA—
Albertville, Birmingham, Montgomery
ARMSTRONG EQUIPMENT CO.

CALIFORNIA—Bakersfield
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WEST COAST ENGINE & EQUIPMENT CO.
El Cajon
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ANDERSON-O'BRIEN CO.
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GEM EQUIPMENT CO.

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HARRY CORNELIUS CO.

NORTH DAKOTA—Williston
SWEENEY BROTHERS

OKLAHOMA CITY—Oklahoma City, Tulsa
DIESEL POWER CO.

TEXAS—Corpus Christi, Dallas, Houston, Lubbock, Odessa, San Juan
STEWART & STEVENSON SERVICES, INC.
Plainview
DIESEL POWER, INC.

UTAH—Moab, Salt Lake City
CATE EQUIPMENT CO., INC.

WYOMING—North Casper
WESTERN OIL TOOL & MFG. CO., INC.

IN CANADA—Distributors in all key locations, under
GENERAL MOTORS DIESEL, LTD.
London, Ontario

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Attention, producers: profit with Adomite*

What it is. Adomite is a newly developed and *thoroughly tested fluid-loss control additive* for converting lease crudes to superior fracturing fluids.

What it does. Adomite effectively seals the fracture face and practically prevents loss of fluid into the producing formation. This results in longer fractures and deeper penetration of sand for a given job. Adomite also cleans up rapidly and does not contaminate the produced oil or the formation.

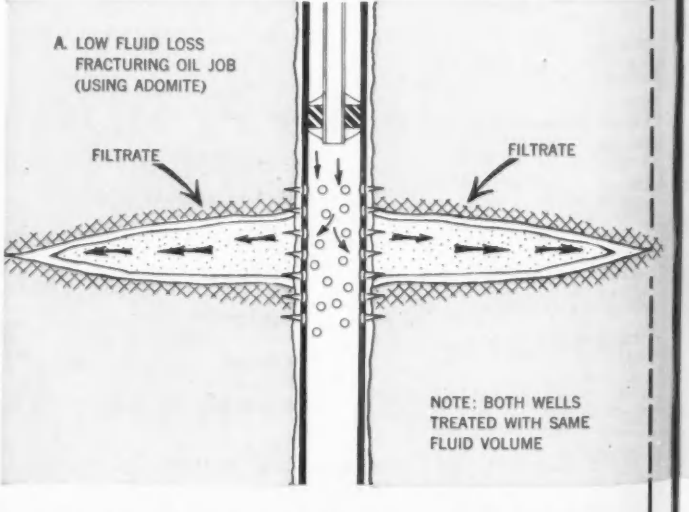
How you profit. You get *greater sustained production* with a given fluid volume *at much lower cost*. Adomite may also enable you to make significant fractures in formations which have proved difficult to fracture with conventional techniques.

Form and availability. Adomite is a dry material in flake form now available through fracture service companies.

Utility. Adomite is easy and convenient to use. It is mixed directly into the crude or gelled crudes on the lease using only the standard mixing equipment necessary for fracturing. If the operator prefers a viscous material, Adomite may be used to reduce the fluid loss of gelled crudes offered by many service companies.

Adomite is equally effective in oils which have or have not been treated with emulsion breakers. It will tolerate small percentages of water sometimes present in crude on the lease and has little or no effect on viscosity of the oil. When Adomite is used, neither the formation nor the well's early production is contaminated with heavy residuals.

How it works. Adomite greatly retards fluid loss into the formation. Thus *more* fluid is retained to extend the fractures, allowing the sand to penetrate more deeply to sustain increased production.



*Trade-mark, Continental Oil Company

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

t with

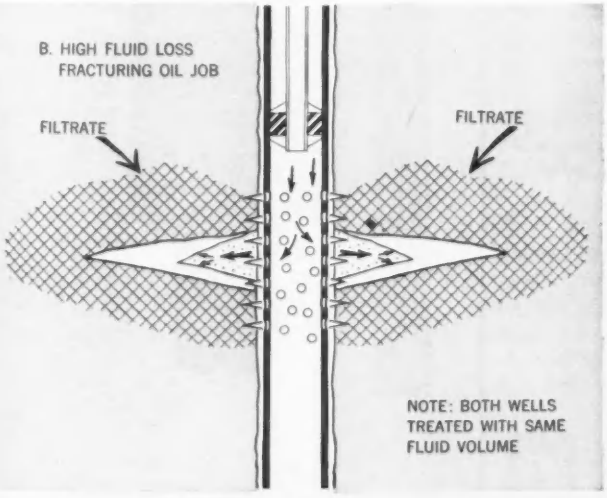
A new concept in hydraulic fracturing—proved by experience!

RESULTS WITH ADOMITE PROVED BY EXPERIENCE

Adomite gives greater fracture area at lower cost than when conventional high fluid-loss type fluids are used. Thus, the BOPD is greater and the cost of the fracture job is much less.

To date, Adomite has been used successfully in over 500 fracture jobs in different fields. Following are examples of actual cases showing typical results obtained when fracturing is done with lease crude to which a small fraction of a pound of Adomite per gallon has been added.

1. Sustained Fracture Production—*Oklahoma.* First well fractured with Adomite in June, 1954. Production increased from 8 to 50 BOPD. Production 10 months later still 50 BOPD. *Wyoming.* Well fractured with 5,000 gallons Adomite-treated lease crude and 5,000 pounds sand. Production increased from 25 to 40 BOPD immediately following fracture. Six months later production was 65 BOPD.



2. Increased Production—*West Texas.* Well fractured with 10,000 gallons Adomite-treated lease crude and 20,000 pounds sand. Production increased from 75 to 576 BOPD.

3. Refracturing—*Kansas.* Well fractured with 10,000 gallons Adomite-treated lease crude and 12,000 pounds sand. Flowed 216 BOPD. This was third time well had been fractured, the two previous times having been with conventional fluid. Well had been shut in before fracturing.

4. Difficult Treating Area—*South Louisiana.* Well fractured with 10,000 gallons Adomite-treated lease crude and 10,000 pounds sand. Production increased from 0 to 160 BOPD. Previous fracturing in area sanded out at less than 2,000 pounds sand with conventional fluid.

5. Reduced Treatments—*West Texas.* In a field, 10,000 gallons of Adomite-treated crude oil injected at 8 bbl./min. gave as good, or better, results than were obtained in offset wells treated with 20,000 gallons conventional type fluid, injected at 40 bbl./min.

6. High Bottom Hole Temperature—*South Texas.* Adomite-treated lease crude has been used to put away 6,000 pounds sand in a formation having a temperature of 245°F. Ordinary fluids break down at this temperature.

©1955, Continental Oil Company.

Ask your service company to use Adomite on your next fracture job

Adomite—DEVELOPED AND MANUFACTURED BY CONTINENTAL OIL COMPANY

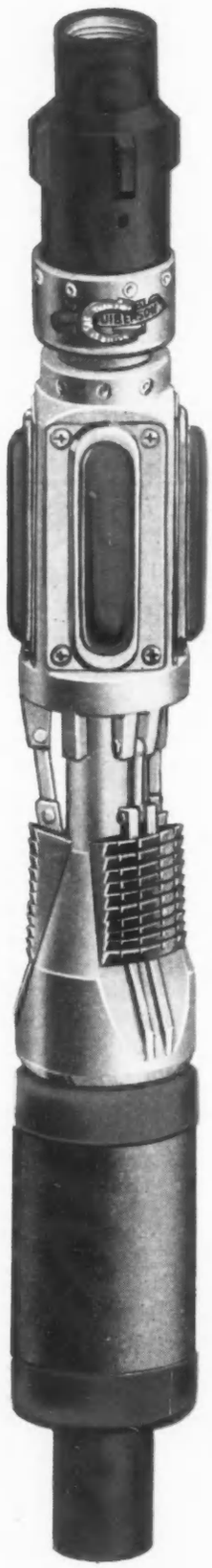
Short Length... Long Service

GUIBERSON AF PACKER

for acidizing, flooding, fracturing and other below packer pressure operations

The solid head packer you've been wanting a long time and at a price you'll be glad to pay. The AF is short, compact, strong and reliable in operation. Positive seal of pressure below the packer at any depth. Design features include friction pads, automatic latch and dove-tail slips and head. Special rubber has built-in ability to return to original shape. It will not vulcanize to casing wall and is acid, oil and gas resistant. Best of all, here is a packer you can handle—in the well or out! Over-all length of 5½" or 7" size is less than four feet!

See this packer at your favorite supply store.

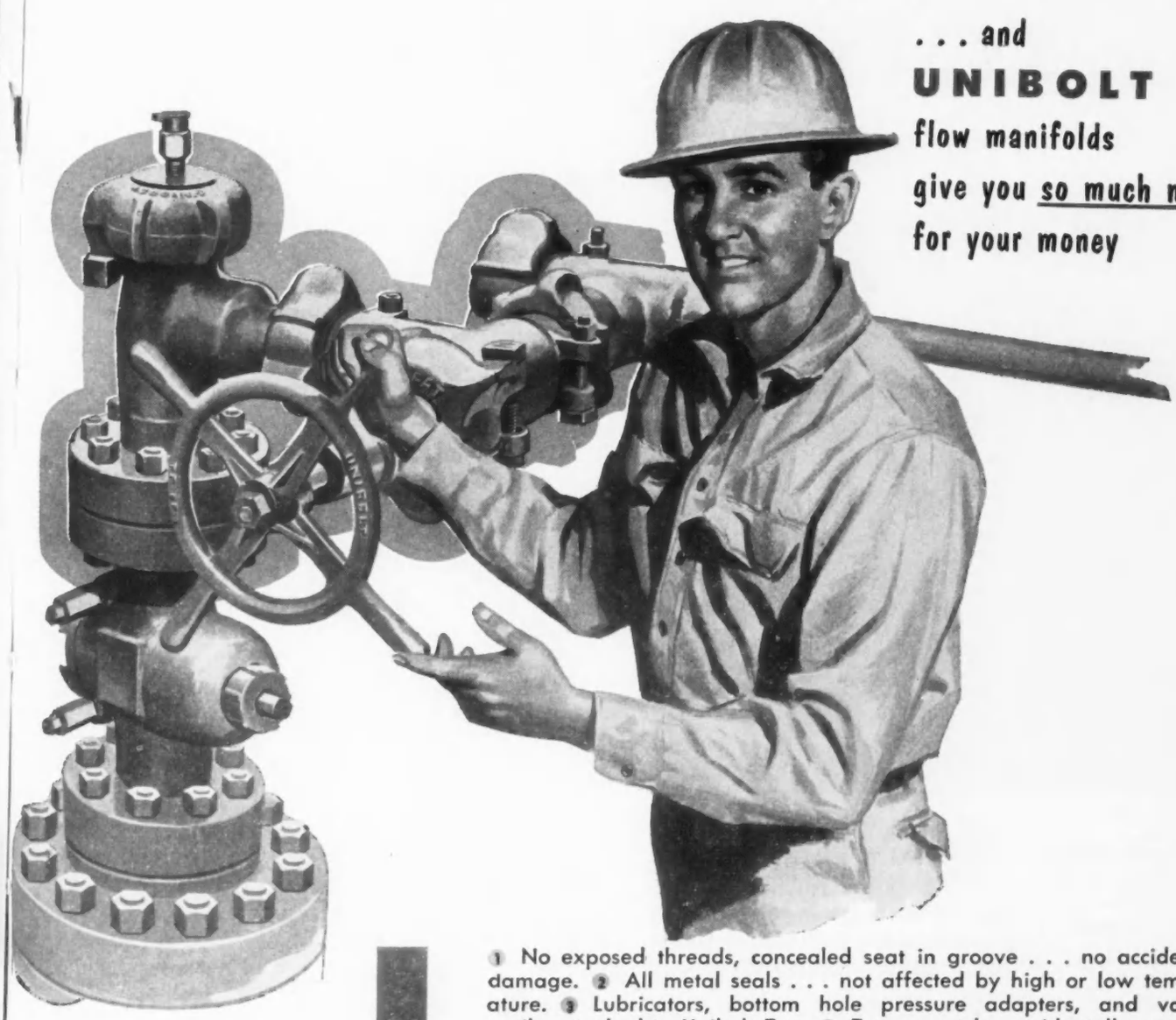


SAFE THAN SORRY GUIBERSON BETTER BE

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

It costs so little more to "go first class"

. . . and
UNIBOLT
flow manifolds
give you <u>so much more</u>
for your money



Pressure-tested as a unit and available in a full range of pressures:

3000 lbs. w.p.
5000 lbs. w.p.
10000 lbs. w.p.

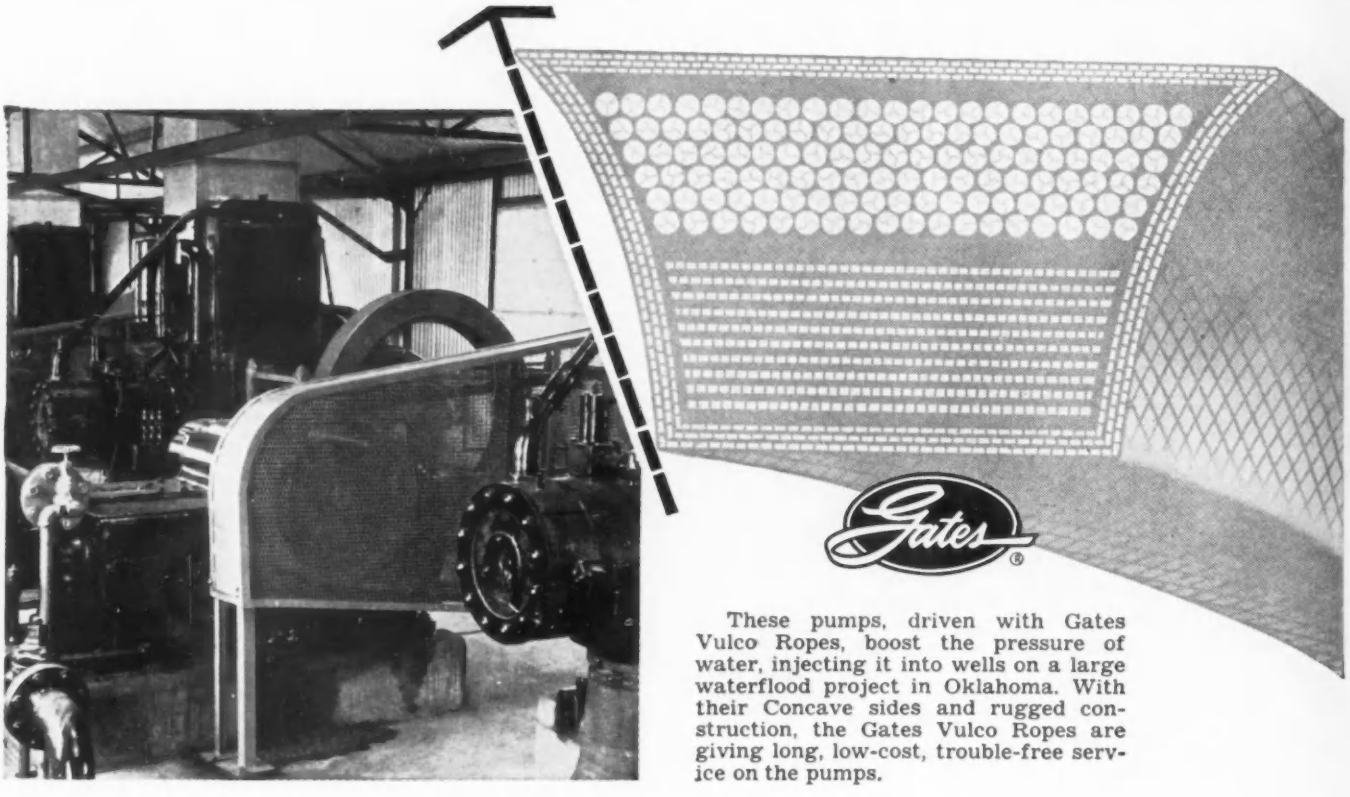
and in "SA" stainless steel for corrosive conditions.

1 No exposed threads, concealed seat in groove . . . no accidental damage. 2 All metal seals . . . not affected by high or low temperature. 3 Lubricators, bottom hole pressure adapters, and valves easily attached to Unibolt Tee. 4 Tee cannot be accidentally opened. 5 Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in Tee if desired. 6 Wing Valve requires no grease to effect seal. 7 Variable opening speeds up initial clean-up or running initial flow tests . . . saves rig time. 8 Unrestricted 1" opening in Wing Valve will pass 10,000 bbls. fluid per day with 100 lbs. pressure drop. 9 Valve stem packing needs no tightening . . . stem turns freely under high pressures. 10 Threads on stem not exposed to internal or external damage . . . full 2½" pilot for true stem alignment and rigidity. 11 Stem seat sealed by power threads and metal gasket assures alignment. 12 Nitride hardened stem and stem seat . . . resists corrosion. 13 Choice of hard chrome plated or "SA" stainless stems and seats. 14 Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated. 15 Shaped entrance on beans prevents paraffin clogging. 16 Positive Choke Body may be replaced with inexpensive tee and cage nipple, or can be converted to Adjustable Wing Valve by substituting two parts. 17 Streamlined flow . . . no obstructions . . . no turbulence.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

"Secret" of *lower* belt costs is concave sides



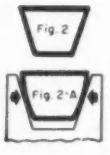
These pumps, driven with Gates Vulco Ropes, boost the pressure of water, injecting it into wells on a large waterflood project in Oklahoma. With their Concave sides and rugged construction, the Gates Vulco Ropes are giving long, low-cost, trouble-free service on the pumps.

Plants that keep track of costs on drives know this: they get longer wear at *lower cost per year of service* when they specify Gates Vulco Ropes—the V-Belts with *concave sides.*

Here's WHY concave sides keep belt costs down:

When the Gates belt is bent around the sheave, the *precisely engineered* concave sides (Fig. 1) fill out and become straight (Fig. 1-A). Thus the belt makes uniform contact with the sides of the pulley.

This full, uniform contact assures *even distribution of wear.* Naturally, *even wear* means *longer wear.* And longer wear cuts belt replacement costs...reduces down time...contributes to profits.



Prove to yourself the value of concave sides

Bend a straight-sided belt (Fig. 2) and feel the sides *bulge out* around the bend. You see immediately that the bulging sides prevent an even fit in the pulley groove (Fig. 2-A). Uneven contact causes faster wear...increases belt replacement costs.

Reduce costs and down time for belt replacements—specify Gates Vulco Rope Drives—the V-Belt with *concave sides* (U.S. Patent 1813698). The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

Gates Engineering Offices and Distributor Stocks are located in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 46-C

GATES VULCO ROPE DRIVES

Seaworthy towing power at the Master's touch...

When towing several million dollars in drilling equipment to a tidelands location, you want the services of seamen who know the sea as well as you know the oil business.

G & H Towing Company has these qualifications to offer:

EXPERIENCE	35 years in harbor and offshore towing.
EQUIPMENT	18 modern diesel-powered tugs.
STAFF	Licensed crews who have navigated for years in these waters.
SPEED	Prompt dispatch of tugs within 2 to 4 hours of your order.
VERSATILITY	Large or small, if it floats, we can tow it — well, anywhere in the Gulf or Latin American waters.

Let us plan with you and solve your offshore towing problems.

G and H

DAY OR NIGHT PHONE
Galveston 3-6468 or 3-4673
Houston YU 5406 or WA 8-5406
Corpus Christi TU 4-8791

G and H TOWING COMPANY INC.

18 MODERN DIESEL POWERED TUGBOATS AT YOUR SERVICE 24 HOURS A DAY

HOUSTON — GALVESTON — CORPUS CHRISTI

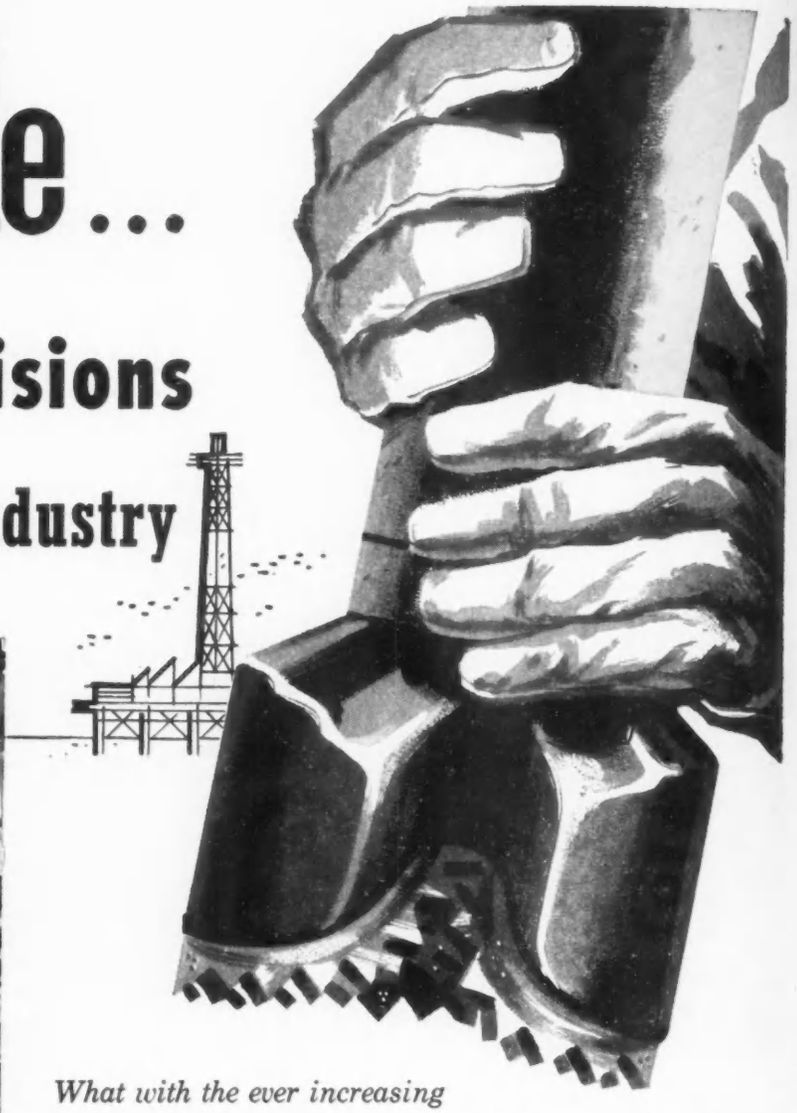
802 U. S. National Bank Building

5675

Avondale...

now 4 divisions

serving the Oil Industry



What with the ever increasing off-shore oil activity, the 4 divisions of Avondale become relatively more important as services to the Oil Industry! In truth, the 4 divisions comprise a team to serve the Oil Industry—every phase of it, from production to refining. Service Foundry Division—casting, gear cutting, machine work. Harvey "Quick Repair Plant"—drydocking, expert propeller service. Main Yard—steel fabricating, ship, barge, towboat building, and repairs. Avoncraft Division—Porcelain Enamel Service Stations.

SERVICE • INTEGRITY • EFFICIENCY

SHIP BUILDING · SHIP REPAIRING · FOUNDERS · PROPELLERS · STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC. CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 4561 • NEW ORLEANS 8, U. S. A.

AVAILABLE JOHNSTON by AL CAPP

"MANIAC'S MOON" IS FULL, TONIGHT!! IS YO' AVAILABLE, AVAILABLE?
AH IS ALLUS AVAILABLE, T' RUN ACCURATE TESTS!!
82 JOHNSTON
AN' THEY'S ACCURATE, BECUZ US JOHNSTONS SPESHULIZES IN DRILL-STEM TESTIN'!!—WE GOT SPESHUL E-KWIPMUNT, SO WE CUTS LOST DOWN-TIME TO A MINNY-MUM!!
"MANIAC'S MOON" IS GOIN' DOWN!! WE IS LOSIN' TIME!! WOULDN'T YO' DRUTHER--
US JOHNSTONS DRUTHER MAKE DRILL-STEM TESTS THAN ANYTHING— IF WE HAD OUR DRUTHERS!!
82 JOHNSTON OFFIZZES IN THE OIL COUNTRY
Capp

C-543

Copr. Capp Enterprises 1954

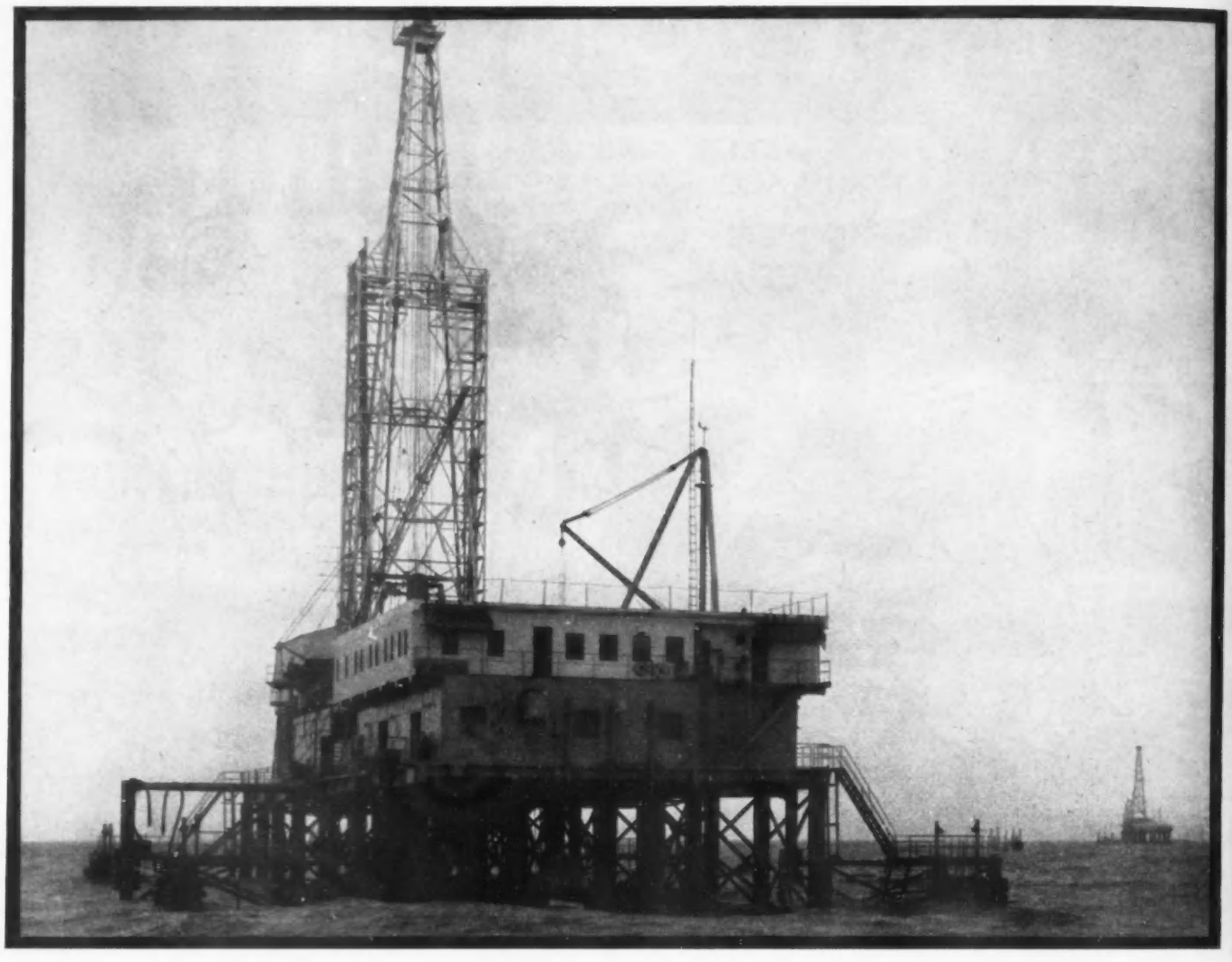
JOHNSTON TESTERS

first in drill stem testing

HOUSTON, TEXAS

LOS ANGELES, CALIF • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON



ALEXANDER COMPLETES NO. 2 FOR ODECO
JOHN HAYWARD JOINS MR. CHARLIE IN GULF

Alexander Shipyard continues its pace-setting activity in deep-water drilling design and construction by completing Odeco's second offshore drilling giant, the John Hayward. Alexander's first barge for Odeco was the much heralded Mr. Charlie, (pictured in background) after which the John Hayward was patterned.

The submersible barge is 180′ x 60′ x 10′ with an overall height of 74′ from the bottom of the hull to the top of the helicopter deck. Its drilling capacity is 18,000 feet in 30 feet of water and it comfortably accomodates 40 men in air-conditioned quarters.

Alexander Shipyard's outstanding design and construction facilities are available for large and small jobs alike. If your concern is planning a marine project, contact Alexander Shipyard.

ALEXANDER Shipyard INC.

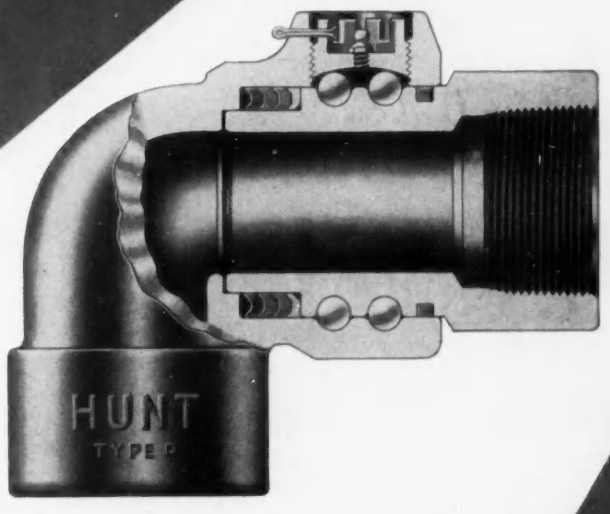
P.O. Box 8126, New Orleans, La. • Valley 2408

PIONEERS IN OFFSHORE DESIGN AND CONSTRUCTION

HUNT

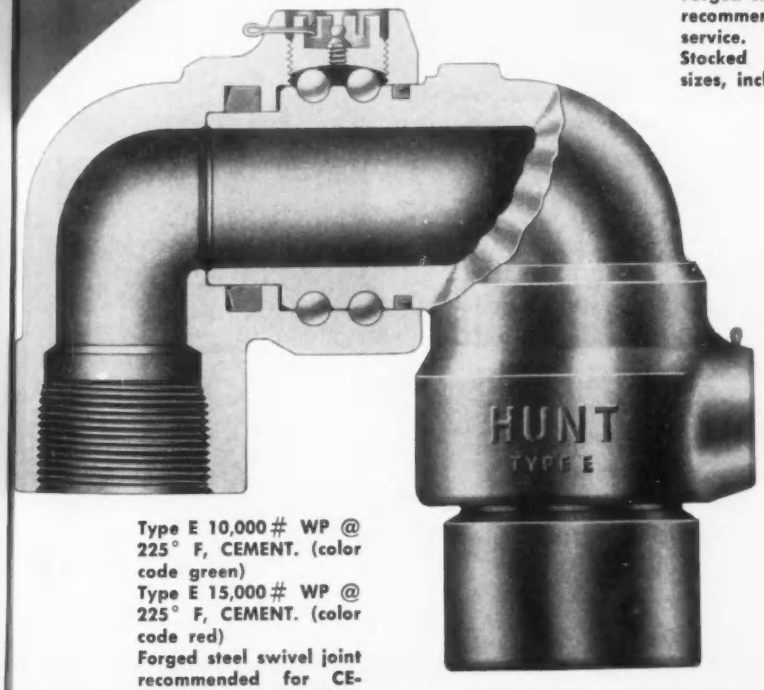
FORGED STEEL SWIVELS

Heat treated forged steel body utilizes double ball principle—allows low torque under high pressure.



Type D 6,000 PSI WP @ 225° F, OWG. (color code aluminum).
Forged steel swivel joint recommended for OWG service.
Stocked in ¾" to 4" sizes, incl.

Type DS 500 PSI WP @ 600° F, HI-TEMP. (color code yellow).
Forged steel swivel joint. Recommended for HIGH TEMP. service.
Stocked in ¾" to 4" sizes, incl.



Type E 10,000# WP @ 225° F, CEMENT. (color code green)
Type E 15,000# WP @ 225° F, CEMENT. (color code red)
Forged steel swivel joint recommended for CEMENTING service. Stocked in 2" only.

MUD GUNS
ALL-STEEL DRILLING HOSE
ALL-STEEL CEMENTING HOSE
ALL-STEEL CIRCULATING HOSE
FORGED STEEL SWIVEL JOINTS

Call your nearest Supply Store.

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Field Shops: Bay City & Corpus Christi, Texas; Jennings & Harvey, La.
Marine Division: Harvey, La.
Export Sales: Hunt Export Company, 19 Rector St., New York
Houston, Texas; Buenos Aires; Port of Spain; Caracas

HUNT TOOL COMPANY

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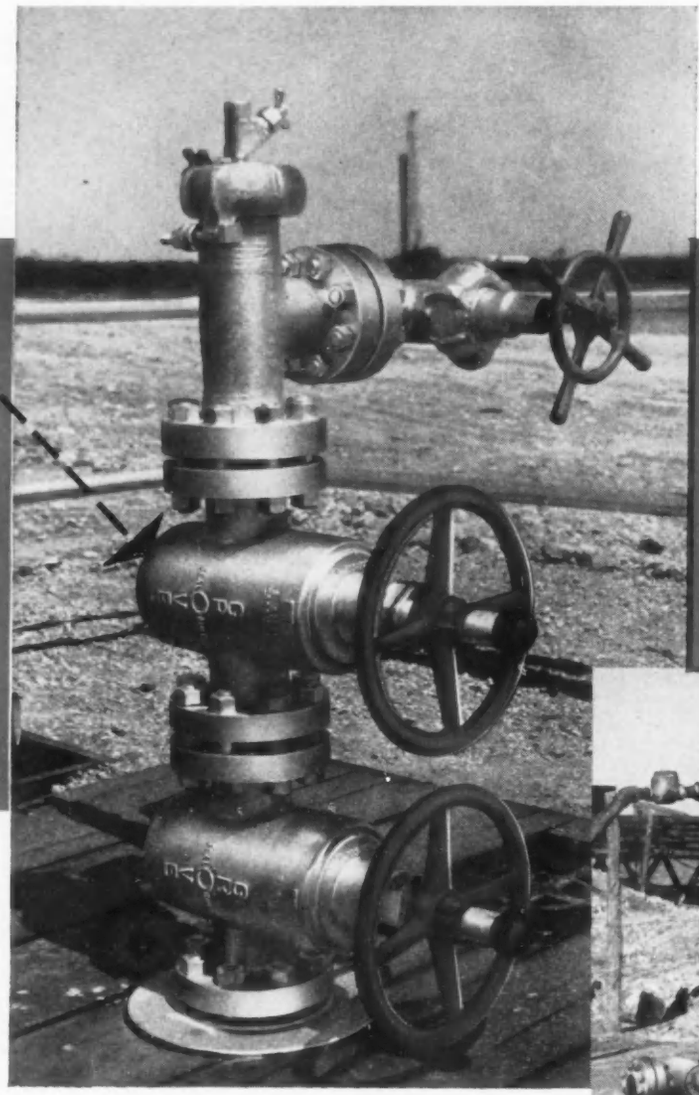
A BUSINESS BUILT ON *Good* SERVICE

WELL-HEAD PUNISHMENT



won't impair sealing efficiency or operating ease of

GROVE SEAL-"O"-RING GATE VALVES

Grove "Christmas trees" in every major producing area have proved the important fact that rocks, mud, sand and other foreign matter are carried through these full-opening Seal-"O"-Ring valves during the cleanout period without damaging gate or seat—without impairing the characteristic ease of operation provided by the parallel-sided free sliding port plate. Scraping action of the metal seat, and squeegee effect of the "O" ring seals, clean and polish the gate with each operation, maintaining absolute bubble tight seal. Small wonder that many important producers are already specifying Grove Seal-"O"-Ring Gate Valves for every new and replacement well-head application. Get full details today.

501

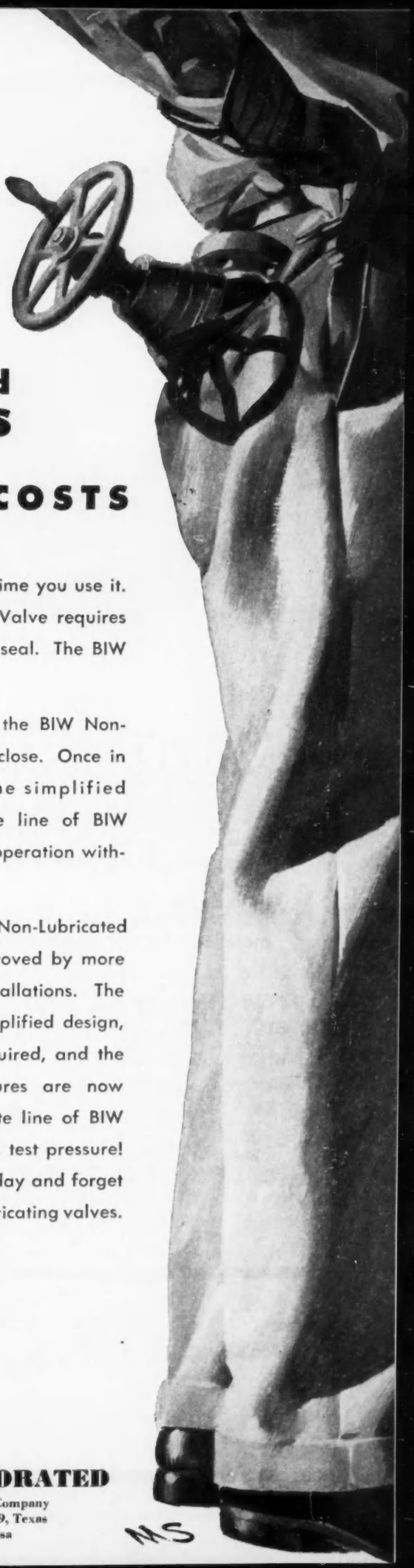
GROVE SEAL-"O"-RING Gate Valves

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, California
HOUSTON 4—1901 Calumet St. • • • • • • • • **LOS ANGELES 6**—1930 W. Olympic Blvd.

ODESSA, TEX. • TULSA, OKLA. • LAFAYETTE, LA. • CHICAGO, ILL. • DENVER, COLO. • In Western Canada: GROVE VALVE LIMITED

GROVE SEAL RING — GROVE SIMPLICITY ACCURACY SAFETY

MONEY IN YOUR POCKET

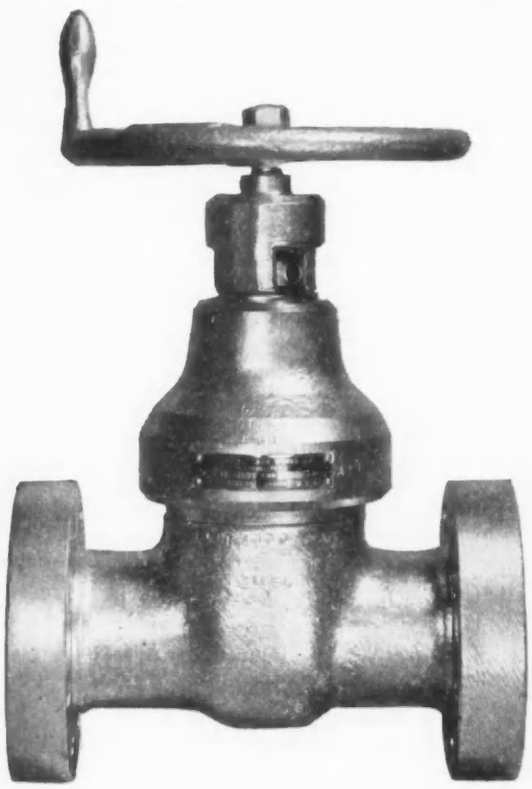


BIW Non-Lubricated GATE VALVES

CUT VALVE MAINTENANCE COSTS

A BIW Non-Lubricated Gate Valve is money in your pocket every time you use it. Money that is saved on day to day maintenance. For the BIW Valve requires **no lubrication** to make a seal and **no lubrication** to hold a tight seal. The BIW Non-Lubricated Gate Valve makes **economy** a fact.

But as important as economy is the complete dependability of the BIW Non-Lubricated Gate Valve. It is always ready and easy to open or close. Once in you can forget it. The simplified design of the complete line of BIW valves insures years of operation without trouble.



The design of the BIW Non-Lubricated Gate Valve has been proved by more than 35,000 field installations. The metal to metal seal, simplified design, low opening torque required, and the many other BIW features are now available in the complete line of BIW valves, up to 15,000 lbs. test pressure! See the BIW engineer today and forget about the problem of lubricating valves.

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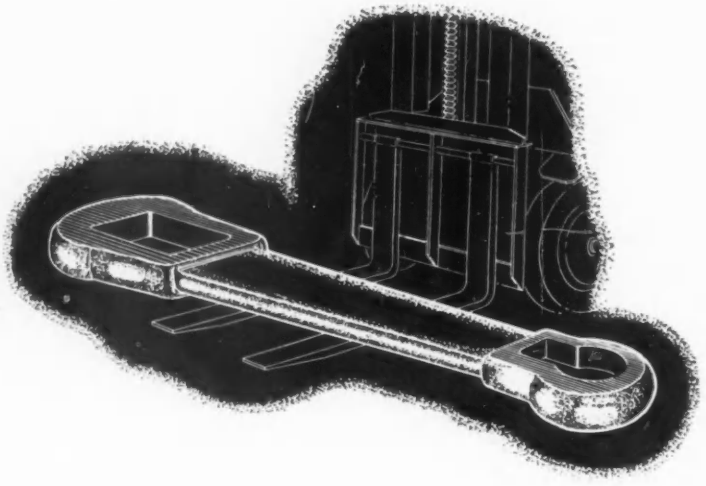
MS

Worn? Mismachined?



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Connecting rods, power cylinders, shafts, rods—i.d. or o.d. surfaces—all can be restored to design dimensions by the application of VANDERLOY.

VANDERLOY* **an electrolytic iron that bonds atomically with most ferrous metals, aluminum, copper, nickel and their alloys.**

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VAN DER HORST TRADE MARK

TERRELL, TEXAS
OLEAN, NEW YORK
LOS ANGELES, CALIFORNIA**
HILVERSUM, HOLLAND

*Patents applied for

**SparTan Engineering West Coast Licensee

WHO'S MEETING WHERE

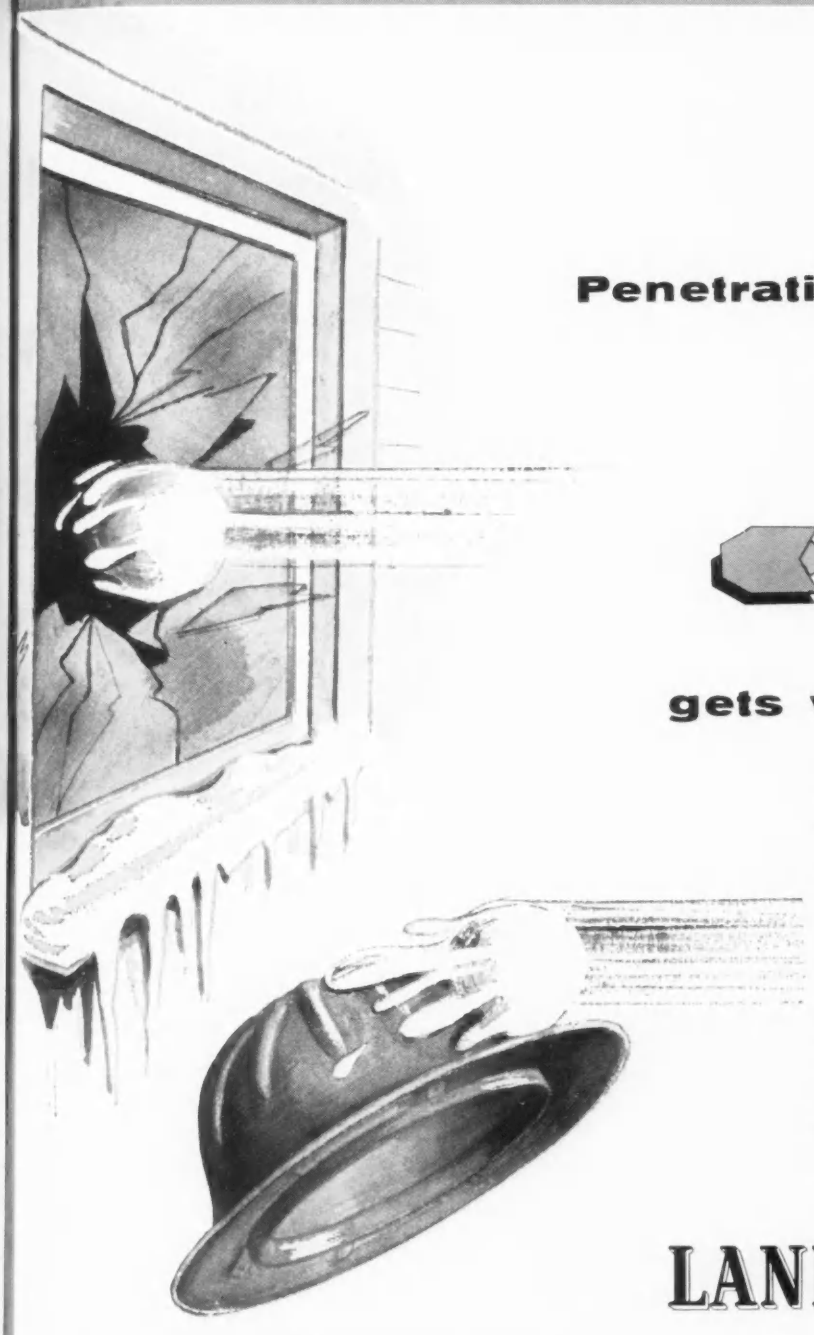
JUNE 5– 9	Canadian Gas Association, Annual Meeting, Sheraton Brock, Niagara Falls, Ont.
6–10	API Division of Production, Midyear Committee Conference, Brown Palace Hotel, Denver.
6–15	Fourth World Petroleum Congress, Rome, Italy.
9–10	Pennsylvania Grade Crude Oil Association, Hotel William Penn, Pittsburgh, Penn.
9–10	Natural Gas & Petroleum Assoc. of Canada, Royal Connaught, Hamilton, Ont.
11–15	Petroleum Equipment Suppliers Association, Annual Meeting, Banff Springs Hotel, Banff, Canada.
16–18	Interstate Oil Compact Commission, Hotel Cosmopolitan, Denver.
20–23	American Society of Mechanical Engineers, Semi-annual Meeting, Hotel Statler, Boston.
23–26	Rocky Mountain Oil Show, Casper, Wyo.
JULY 29–31	Wyoming Geological Association, Annual Field Conference. Rock Springs, Wyo.
SEPT. 2– 3	Association of Desk and Derrick Clubs of North America, Annual Convention, Commodore Hotel, New York City.
14–16	National Petroleum Association, 53rd Annual Meeting, Traymore Hotel, Atlantic City, N.J.
22–23	Mid-Continent Oil & Gas Association (La.-Ark. Division, Annual Membership Meeting), Roosevelt Hotel, New Orleans, La.
25–28	American Association of Oilwell Drilling Contractors, Annual Meeting, Rice Hotel, Houston.
25–28	American Society of Mechanical Engineers, Petroleum Mechanical Engineering Conference, Roosevelt Hotel, New Orleans.
OCT. 2– 5	Petroleum Branch, American Institute of Mining and Metallurgical Engineers, Fall Meeting, Roosevelt Hotel, New Orleans.
3– 4	Texas Mid-Continent Oil & Gas Association, Annual Meeting, Baker Hotel, Dallas.
3– 6	Society of Exploration Geophysicists, Annual Meeting, Shirley Savoy Hotel, Denver.
17–19	American Gas Association, Annual Convention, Los Angeles.
17–21	National Safety Congress, Chicago.
21–23	First Cuban Congress on Petroleum, Sponsored by Universidad de Oriente (University of Oriente), Santiago de Cuba.
27–29	Rocky Mountain Oil & Gas Association, Annual Convention, Cosmopolitan Hotel, Denver.
31– Nov. 1	Independent Petroleum Association of America, Annual Membership Meeting, Jefferson Hotel, St. Louis.
NOV. 14–17	American Petroleum Institute, Annual Meeting, Mark Hopkins, Fairmont, St. Francis and Palace Hotels, San Francisco.

Nomads' Chapter monthly meeting: Los Angeles, second Wednesday, Jonathan Club, Wallace A. Sawdon, Secretary. Houston, second Monday, Ye Old College Inn, Harry E. Estes, Secretary. Dallas-Fort Worth, first Monday Greater Dallas Club, M. W. Hiltpold, Secretary. Tulsa, Hotel Tulsa, Gilbert Swift, Secretary. New York, first Monday, Hotel Biltmore, Jesse E. Hickman, Secretary.

Current Outlook Section

WORLD OIL

L. J. LOGAN, AL REESE
and DON KLIEWER
SECTION EDITORS



Penetration may get results

but

KONESHOT

gets what you aim for!

Bulls-eye in perforating means BPP—Best Possible Production. And that's what Lane-Wells KONESHOT gives you, because KONESHOT delivers the deep penetration of shaped-charge perforating with bulls-eye accuracy through Lane-Wells famous system of on-the-nose depth measurements...puts the shots right where you want 'em! Add to *penetration* and *accuracy* the fast, dependable service of trained crews from Lane-Wells 97 branches, and you get BPS—Best Possible Service. It pays to call Lane-Wells.

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Write for further information on LANE-WELLS KONESHOT

Mr. "B" was in a BIND

When Mr. B. came to see us he was in a bind. He had borrowed on his properties in East Texas to buy some production in Louisiana. Now he discovered that he had a unit which was costing too much to operate. He told us that if he could buy the adjacent property he could work it with no additional equipment and get out of the woods.

We looked into his problem thoroughly, and when he returned we had two proposals to make. We told him we'd lend him enough to buy the new land, so that he would need only $30,000 in cash. But then we asked him if he had ever considered selling his part. We showed him the tax advantages and the excellent cash position it would put him in. He understood what we were telling him, and he sold. He got out from under a bad deal with enough cash to get into a deal which did pay out for him.

We lost the opportunity to make a loan, you say. Yes, but lending is not our only function. In the Oil Loan Department at The National Bank of Commerce we are trying to help and to develop independent oil men. If you have a difficult problem which needs impartial appraisal and advice based on experience, come to see us. This sort of help is why oil men **going up** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

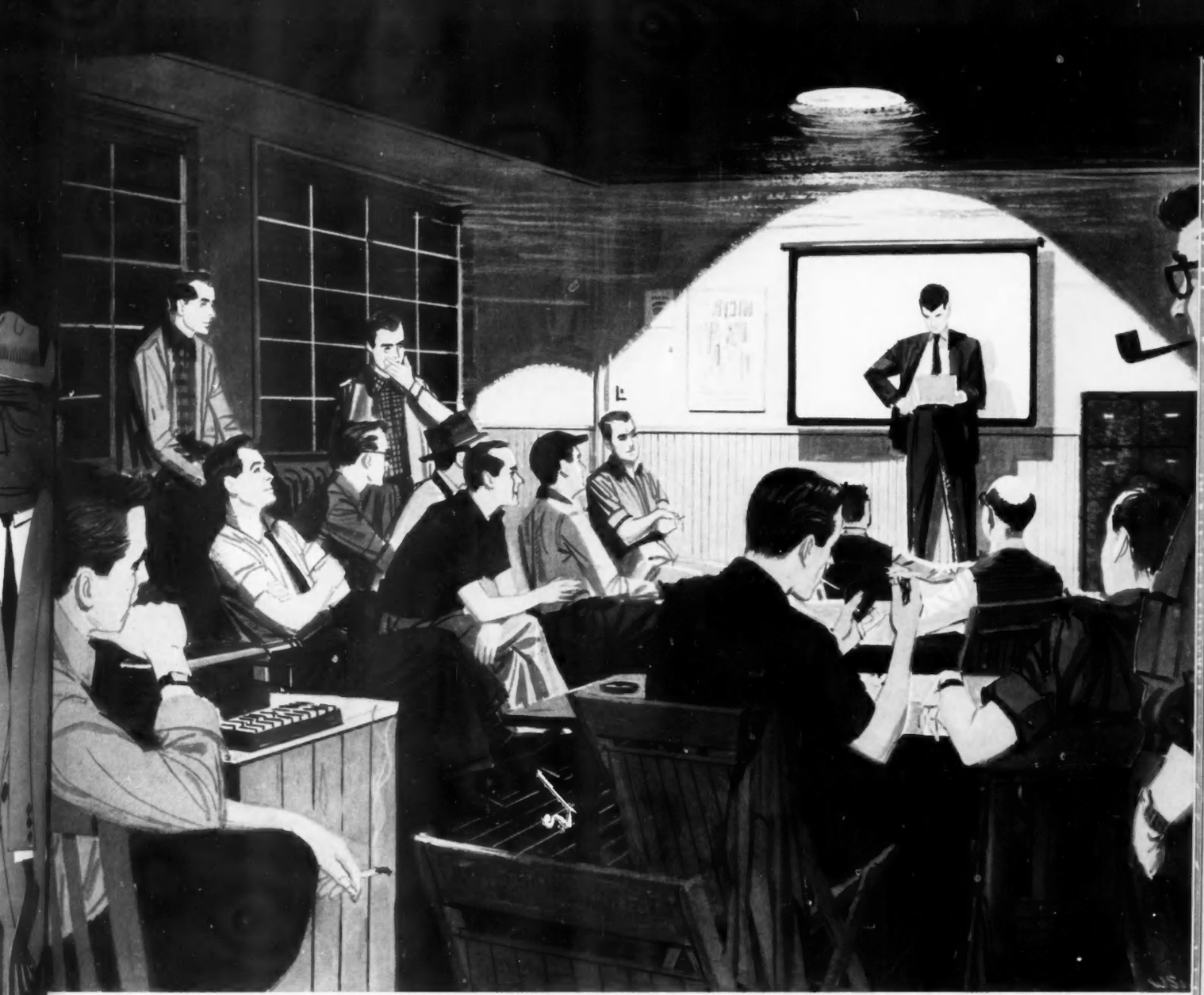
THE NATIONAL BANK OF COMMERCE

OF HOUSTON

Gulf Building, Houston, Texas "The Bank for All the People"

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Facilities of the Oil Loan Department of The National Bank of Commerce are available in Wyoming, Colorado, Nebraska, New Mexico, Texas, Louisiana, and Mississippi



"Shirtsleeve session" at Odessa

TO MAKE YOUR JOB EASIER

It was warm in the back of National Supply's Odessa store that night, but they took off their coats, rolled up their sleeves and started the meeting. In the group were engineers from our Toledo plant, division office personnel, and over fifty store managers and field representatives from various districts in Texas.

Using charts, sectional drawings and photographs, the engineers discussed several new developments in the line of National oilfield equipment. They talked about ratings, laboratory tests, and other factors vitally important to every man in the room. In turn, the field personnel asked questions, made suggestions and outlined operating problems they had encountered. Perhaps some of those problems were yours.

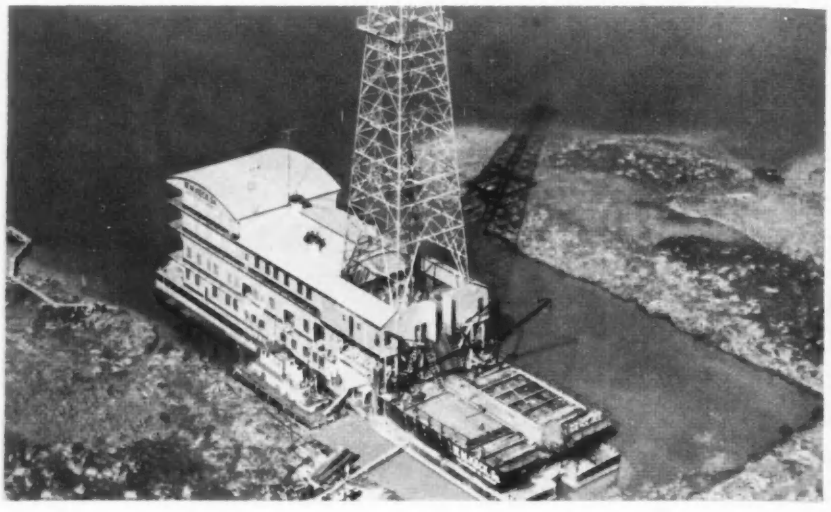
The meeting lasted well into the night, and throughout all of it, a great deal of helpful and practical information was exchanged. Just how does it make your job easier?

Out of regular "shirtsleeve sessions" like this come ideas on how to make a rig, a pump or an engine easier to operate or maintain . . . and ideas on how to give you better service at lower cost. In short, you and thousands of others reap the benefits—in a host of ways you're already familiar with if you've ever done business with National Supply.

THE
NATIONAL SUPPLY
COMPANY

Whatever and wherever the drilling job,

YOU CAN KEEP COSTS LOW WITH AN IDEAL® RIG!



Ask an Ideal Rig owner or operator what he likes about it and you'll get answers like these: It's tough—takes punishment on the most difficult jobs without giving trouble. It's easy to operate, and smooth-running. Easy to maintain, too. And whenever it's moved, there's a minimum of work involved.

Such answers, verified by oil men the world over, add up to one important fact—with an Ideal Rig, you get low cost footage, wherever you operate it.

A close look at any Ideal Rig, especially one in operation, will give you proof of this. Check its compact construction, centralized air controls and large drums. See how easy it is to reach all working parts. Then note how National's special sectionalized design insures lasting factory alignment and simplifies transportation. You'll get a complete picture of a soundly-engineered rig.

Every Ideal Rig is backed by National's continuous research and years of close cooperation with practical operators in every oilfield. Remember, too, that wherever you operate an Ideal Rig, you're not far from the prompt service made possible by National's extensive field supply network.

There are 10 Ideal Rigs in National's complete line—all proved in service from shallow well drilling to the world's deepest wells. You'll find it profitable to take that close look at one that suits your needs—soon!

...and insure smooth power transmission with

IDEAL® DRIVE GROUPS

You'll have the full advantages of a balanced rig when you match integrally designed Ideal Drive Groups with your Ideal Rig. Compact and easy to transport, Ideal Drive Groups are easy to rig-up and disassemble . . . and they provide dependable power transmission under all drilling conditions.

Be sure to get complete details on these outstanding features of Ideal Drive Groups—

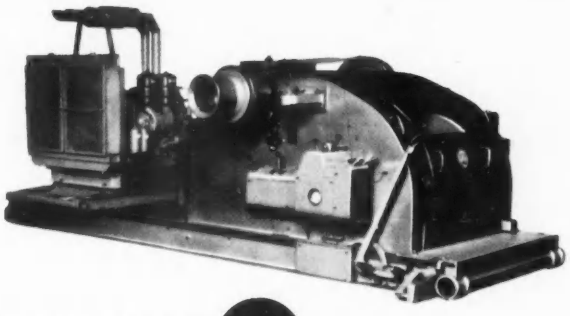
Sectionalized construction, with each section a completely self-contained portable unit.

Wide power range, with flexible engine and drive combinations from 200 to 2000 horsepower.

Slush pump drives, both independent and integral types, for every fluid requirement.

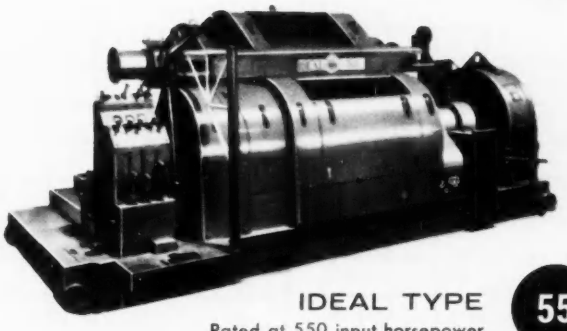
Three types of transmissions—a choice of mechanical, Ideal Gyrol, or National Torque Converter.

Bulletins on Ideal Drive Groups and Ideal Independent Pump Drives are yours for the asking at the nearby National Supply Store.

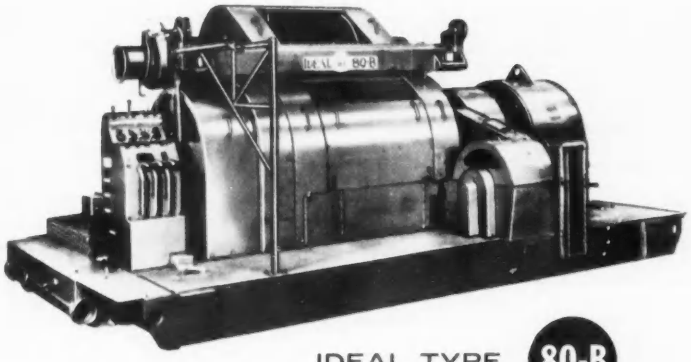


IDEAL TYPE **T-32**
Rated at 320 input horsepower

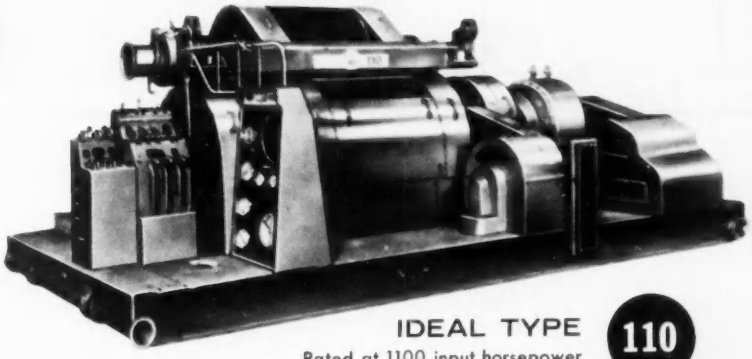
IDEAL TYPE **T-20**
Rated at 200 input horsepower



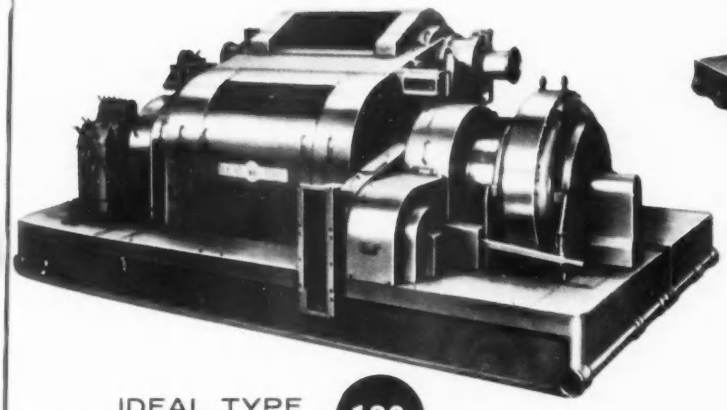
IDEAL TYPE **55**
Rated at 550 input horsepower



IDEAL TYPE **80-B**
Rated at 800 input horsepower



IDEAL TYPE **110**
Rated at 1100 input horsepower



IDEAL TYPE **130**
Rated at 1300 input horsepower

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COMPANY

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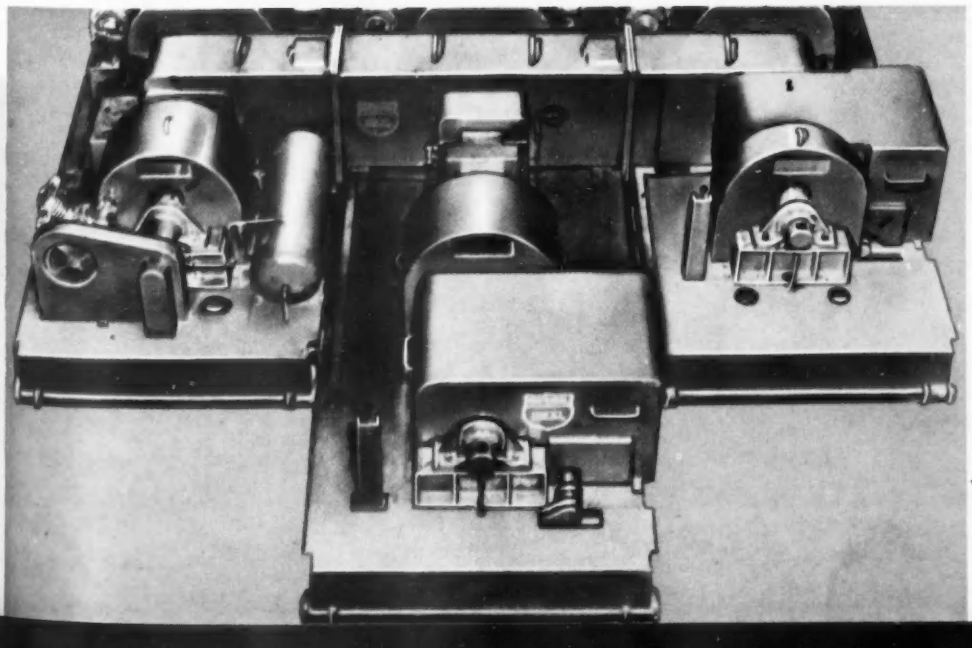
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT • SPANG STEEL PIPE

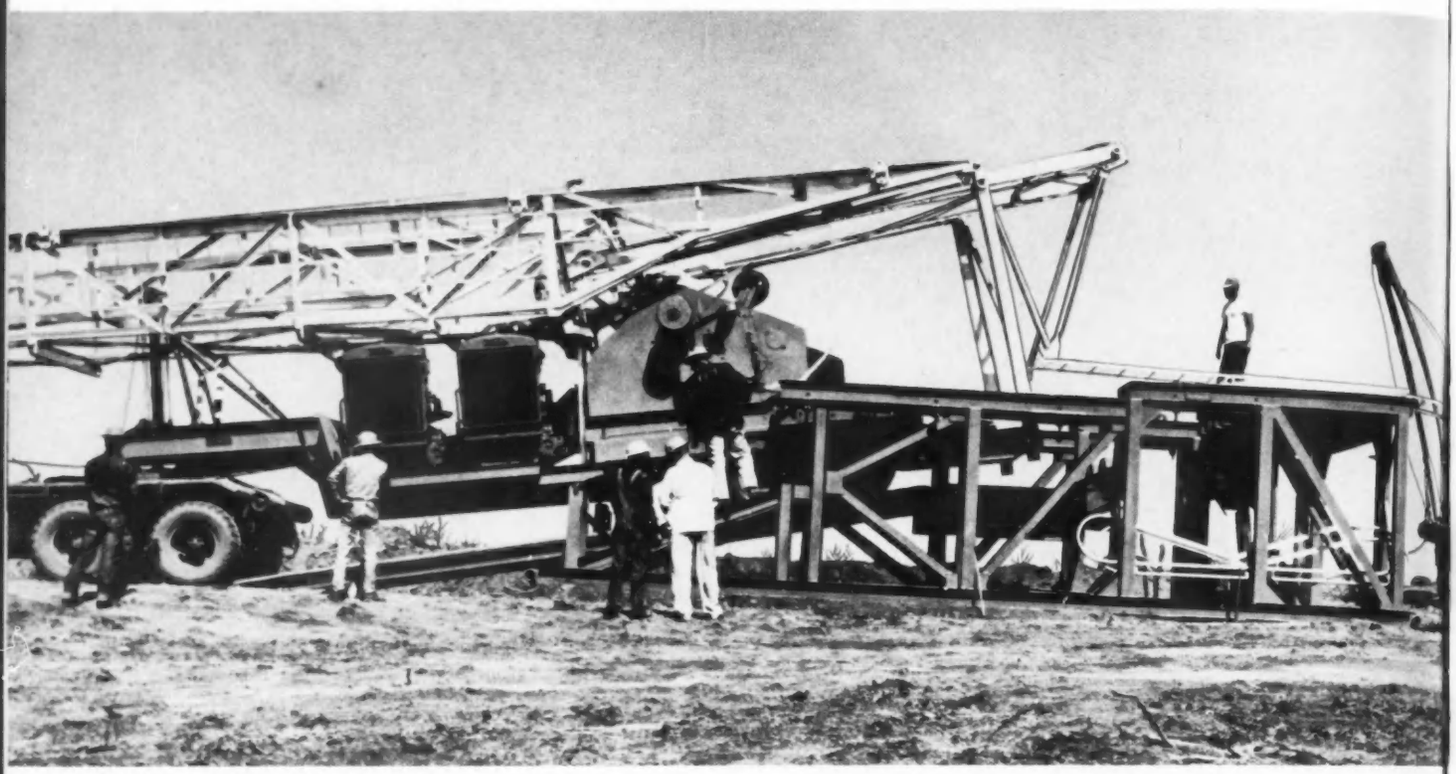


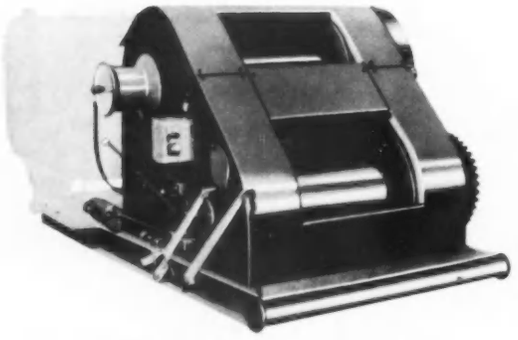
see the portable
IDEAL HOISTS with
big rig features

on the next page

PORTABLE IDEAL® HOISTS

can speed your servicing, workover and shallow well drilling jobs!





IDEAL T-8 HOIST, rated at 80 input horsepower
Servicing and workover range—2,000 to 4,000 ft.
Drilling range—1,000 to 2,000 ft.

IDEAL T-12 HOIST, rated at 120 input horsepower
Servicing and workover range—3,000 to 6,000 ft.
Drilling range—1,500 to 3,000 ft.

Are you losing, "breaking even" or doing little better on the shallow well jobs? You can improve your records by putting one of these portable Ideal Hoists to work.

Ideal Hoists are light, exceptionally compact and built for fast rig-ups and tear-downs. For complete job versatility, they're available as skid-mounted units or as factory-assembled truck or trailer-mounted units. Because you can move them quickly, downtime between jobs is kept to a minimum.

Downtime *on the job* is slight, too, because their operating features parallel the quality and performance-proved features you get in the larger Ideal Rigs. In these Ideal Hoists, you'll find roller-bearing mounted free-running drums, air controls and air-actuated clutches. They also utilize torque converter drive for shock-free operation, and a great range of running speeds.

All of these features make every Ideal Hoist a smooth-running, dependable unit that provides for fast, economical service on the drilling, servicing or workover jobs in its range. Why not get the full story on the one to meet your needs from the National Supply Representative in your area? Be sure, too, to get the new bulletins on the models shown here.

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COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
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SPANG STEEL PIPE

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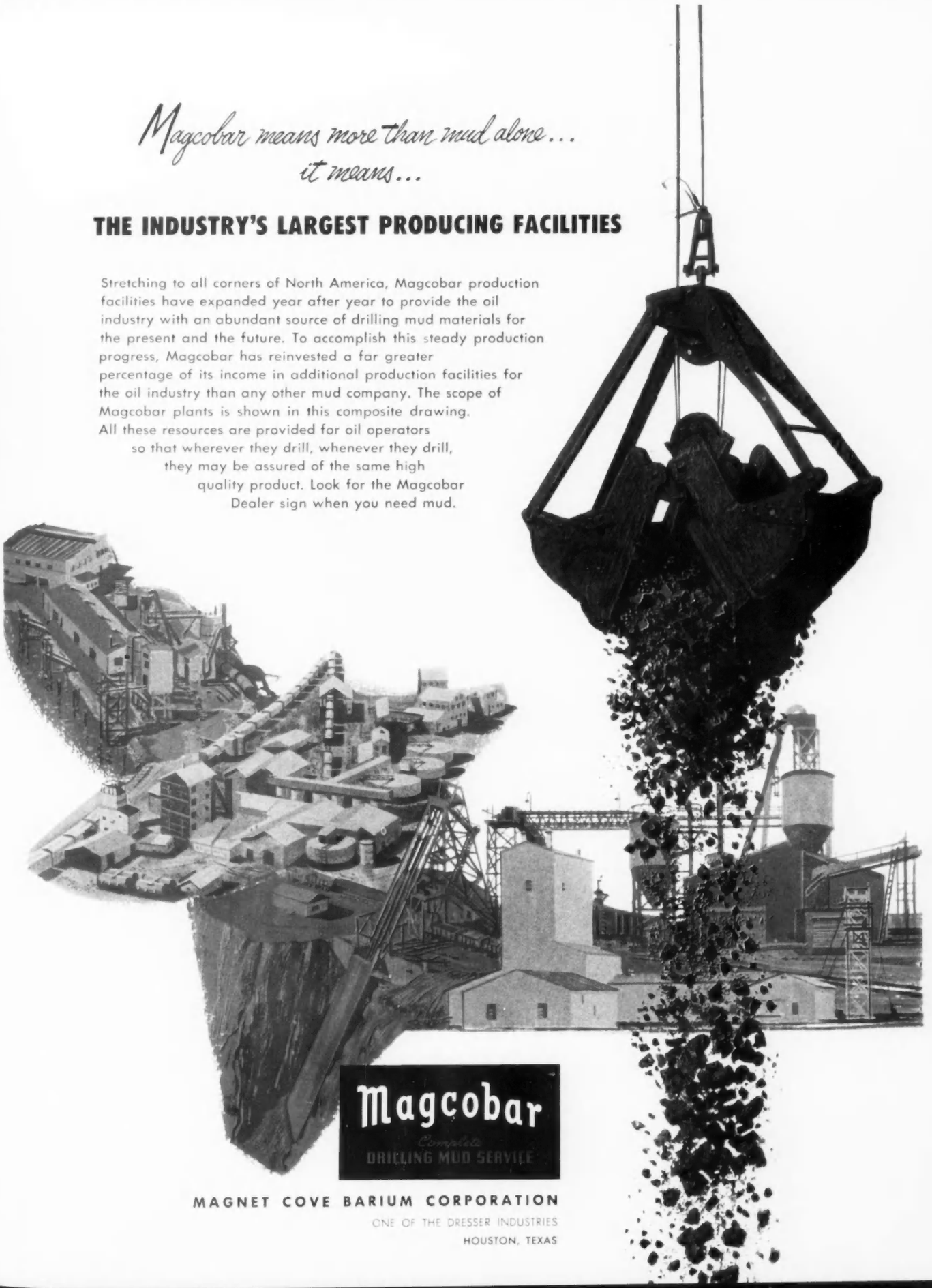
Magcobar means more than mud alone... it means...

THE INDUSTRY'S LARGEST PRODUCING FACILITIES

Stretching to all corners of North America, Magcobar production facilities have expanded year after year to provide the oil industry with an abundant source of drilling mud materials for the present and the future. To accomplish this steady production progress, Magcobar has reinvested a far greater percentage of its income in additional production facilities for the oil industry than any other mud company. The scope of Magcobar plants is shown in this composite drawing. All these resources are provided for oil operators so that wherever they drill, whenever they drill, they may be assured of the same high quality product. Look for the Magcobar Dealer sign when you need mud.



Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION
ONE OF THE DRESSER INDUSTRIES
HOUSTON, TEXAS

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HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

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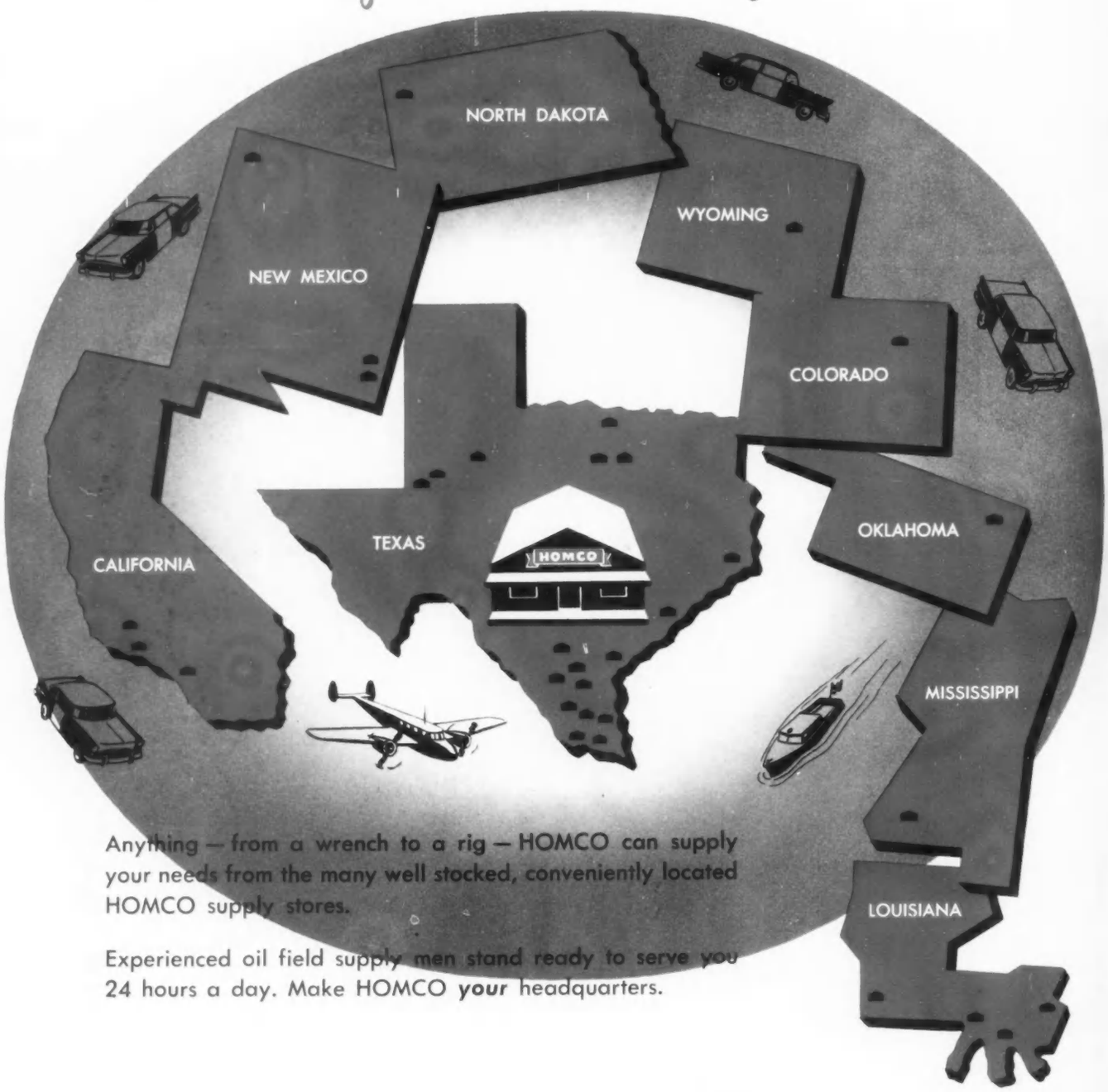
have what you need - when you need it -



Anything — from a wrench to a rig — HOMCO can supply your needs from the many well stocked, conveniently located HOMCO supply stores.

Experienced oil field supply men stand ready to serve you 24 hours a day. Make HOMCO ***your*** headquarters.

OIL INDUSTRY'S MOST *Complete* SERVICE

With service points in the United States at:
TEXAS: **Houston, Beaumont, Bay City, Victoria, Corpus Christi, Alice, Kenedy, Pearsall, Freer, Edinburg, Sullivan City, Dallas, Fort Worth, San Antonio, Midland, Odessa, Snyder, Sherman.** LOUISIANA: **Lake Charles, New Iberia, Houma Harvey, New Orleans.** MISSISSIPPI: **Brookhaven.** NEW MEXICO: **Hobbs, Lovington, Farmington.** OKLAHOMA: **Tulsa.** COLORADO: **Denver.** WYOMING: **Casper.** NORTH DAKOTA: **Williston.** CALIFORNIA: **Long Beach, Bakersfield, Ventura.** General Offices, Manufacturing and Export Division, Houston, Texas.

THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

- DIRECTIONAL DRILLING
- FISHING OR CUTTING
- OIL FIELD SUPPLIES

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

HOUSTON, TEXAS

BROWN TYPE "A" ZONE SELECTOR

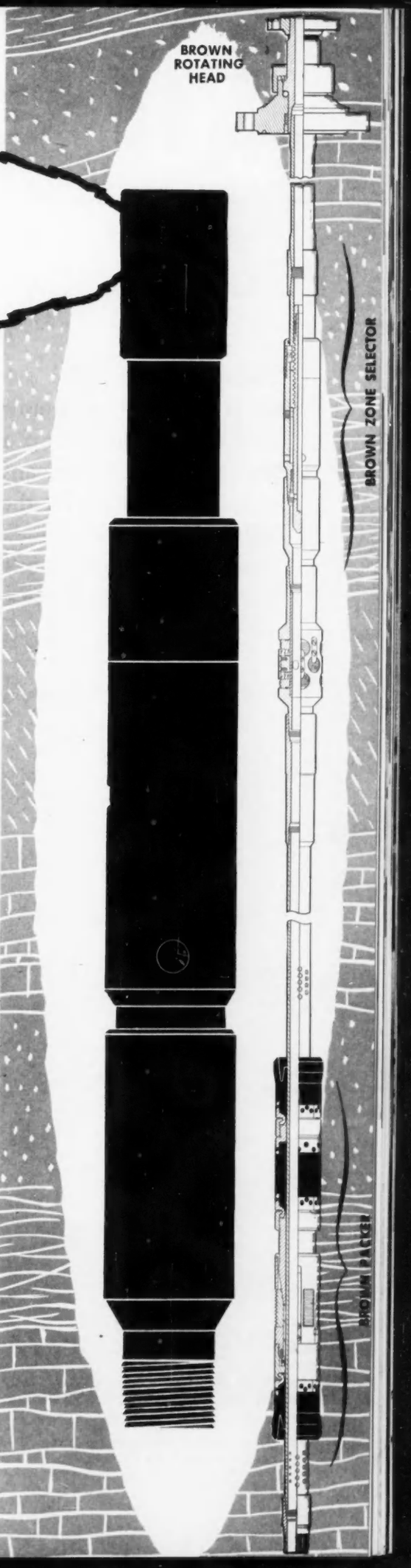
in dual completions . . .

Eliminates

- **OUTSIDE SERVICE CREWS**
- **ZONES CO-MINGLING**
- **KILLING WELL AND PULLING TUBING**
- **DISTURBING PACKER SETTING**

This versatile tool provides the means to perform many necessary operations in dually completed and single zone wells either while flowing or pumping. With the Brown Type A Zone Selector installed in the tubing string above packer you have the versatility and desired features of a conventional ported nipple and wireline pack-off assemblies. A simple manipulation by the well operator at the surface controls its operation and eliminates the need of outside crews with special equipment when flow courses are changed.

Its applications are: (1) In a dual zone well, independent bottom hole pressure and temperature surveys as well as flow potentials can be taken through the tubing. (2) Acidizing and formation fracturing—treating the upper zone without disturbing the lower. (3) "Unloading" the annulus through the tubing and circulating hot oil or other solvents to wash out paraffin. (4) Pumping two zones intermittently with a single pump. (5) In single completion wells when zone selector is run with packer mud can be left on top of packer and well brought in through tubing, also permitting circulation above packer to kill well.



BROWN OIL TOOLS, INC.

2214 CAMPBELL ST.

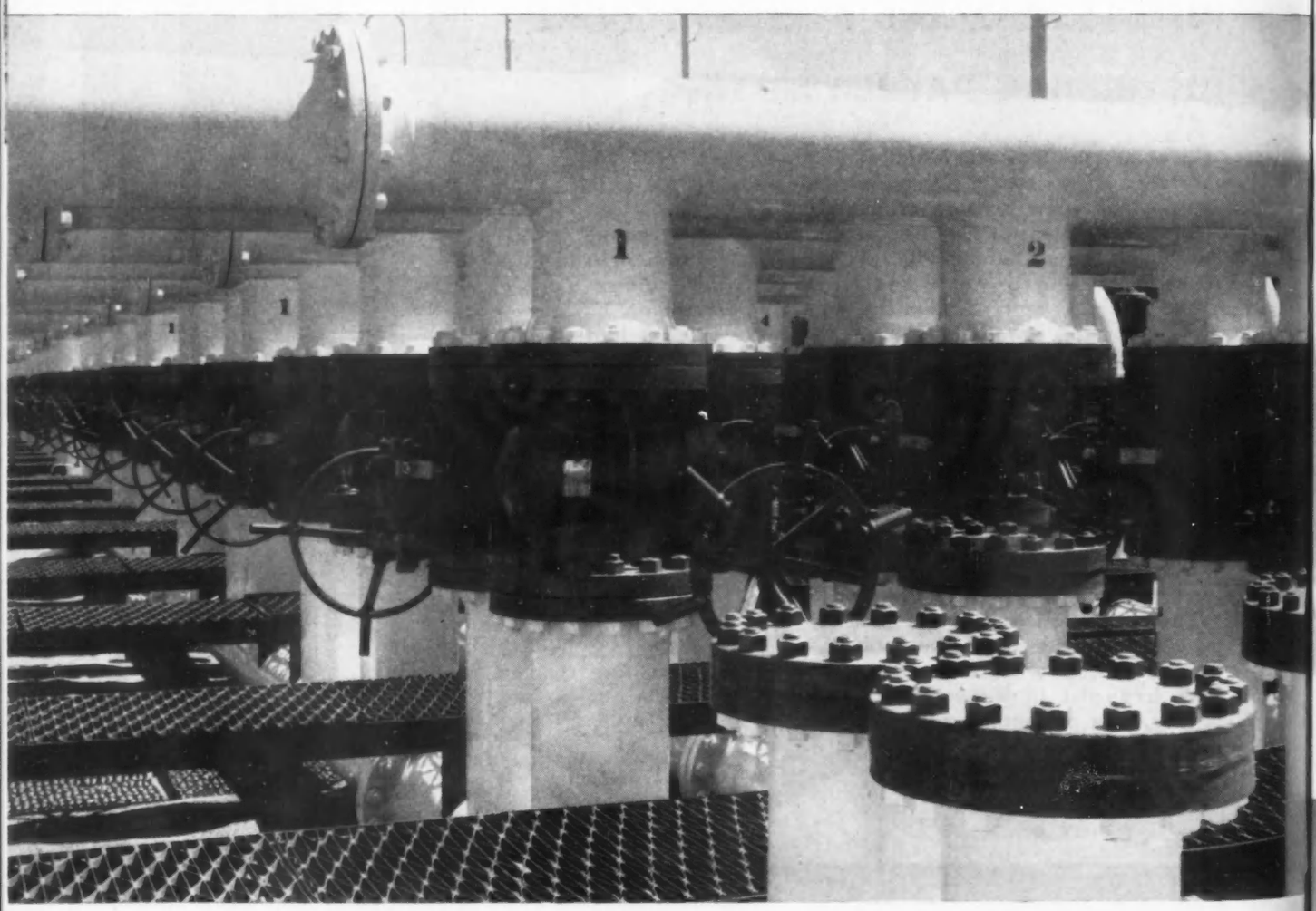
HOUSTON, TEXAS

All along the

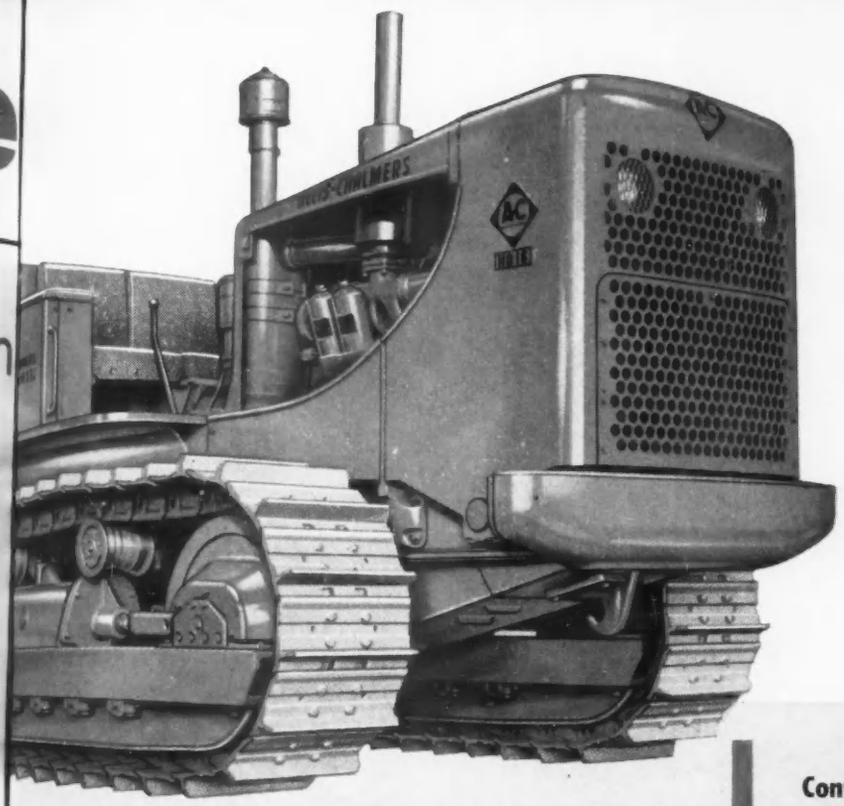
Costs down....efficiency up....with

There are three good reasons why you'll see Rockwell-Nordstrom valves all along most gas, petroleum or products pipe lines. *One:* pressurized lubricant sealing assures leakproof operation for the lightest hydrocarbons or heaviest fluids. *Two:* quarter-turn operation allows easy, positive control . . . ideal for remote power operation. *Three:* costly metal-to-metal friction on the working parts is eliminated by the tough, protective lubricant film . . . repair and replacement costs are slashed.

Valves represent one of the most important investments in any pipe line operation. All over the world, pipe line companies have found that investing in



These Rockwell-Nordstrom gear operated valves provide fast, positive, dependable control at this huge products terminal.



Allis-Chalmers presents the NEW HD-16

Your choice of two outstanding drives

	Torque Converter Drive	Standard Transmission Drive
Horsepower	150 net engine hp	131 belt hp
Weight	31,600 lb	31,500 lb
Drawbar pull	up to 60,000 lb*	up to 35,945 lb*

*Limited, under normal tractive conditions, to 90 percent of total weight of tractor and mounted equipment.

New Standards of Performance *for a wide range of heavy-duty work*

Set your sights on an HD-16! This big new tractor not only brings you *more* power for bigger jobs . . . it makes more effective use of horsepower, with a brand new Allis-Chalmers diesel engine and your choice of two new drives — the job-proved torque converter or the easy-shift standard transmission. Either way, the HD-16 brings you a new high in tractor-operator efficiency . . . a new high in work done under even the toughest conditions.

New Standards of Dependability *under all conditions!*

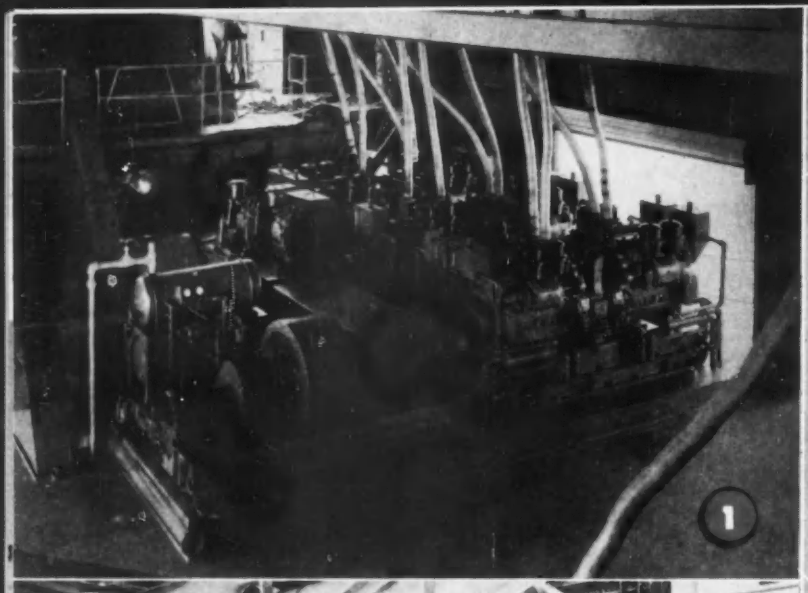
The HD-16 follows the Allis-Chalmers *advanced basic design*, with such important features as its all-steel, Box-A frame and one-piece steering clutch and final drive case...straddle-mounted final-drive gears with tapered roller bearings . . . unit construction . . . . . . simplified lubrication and service designed with *better* maintenance in mind. What's more, it is newly engineered to provide big safety factors in all components . . . plus features like the new Allis-Chalmers heavy-duty diesel engine, new "wrap-around" radiator guard, husky new transmissions, new true-dimension track, and many others.

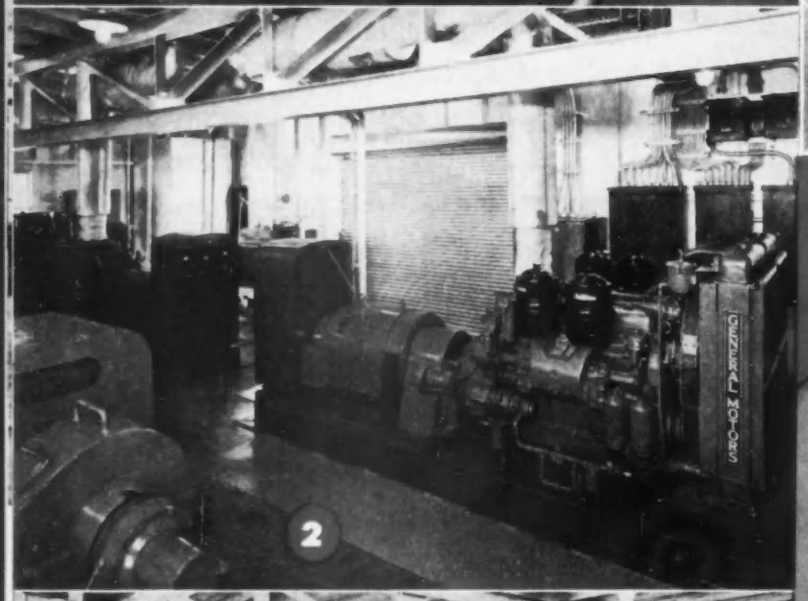
☆ ☆ ☆

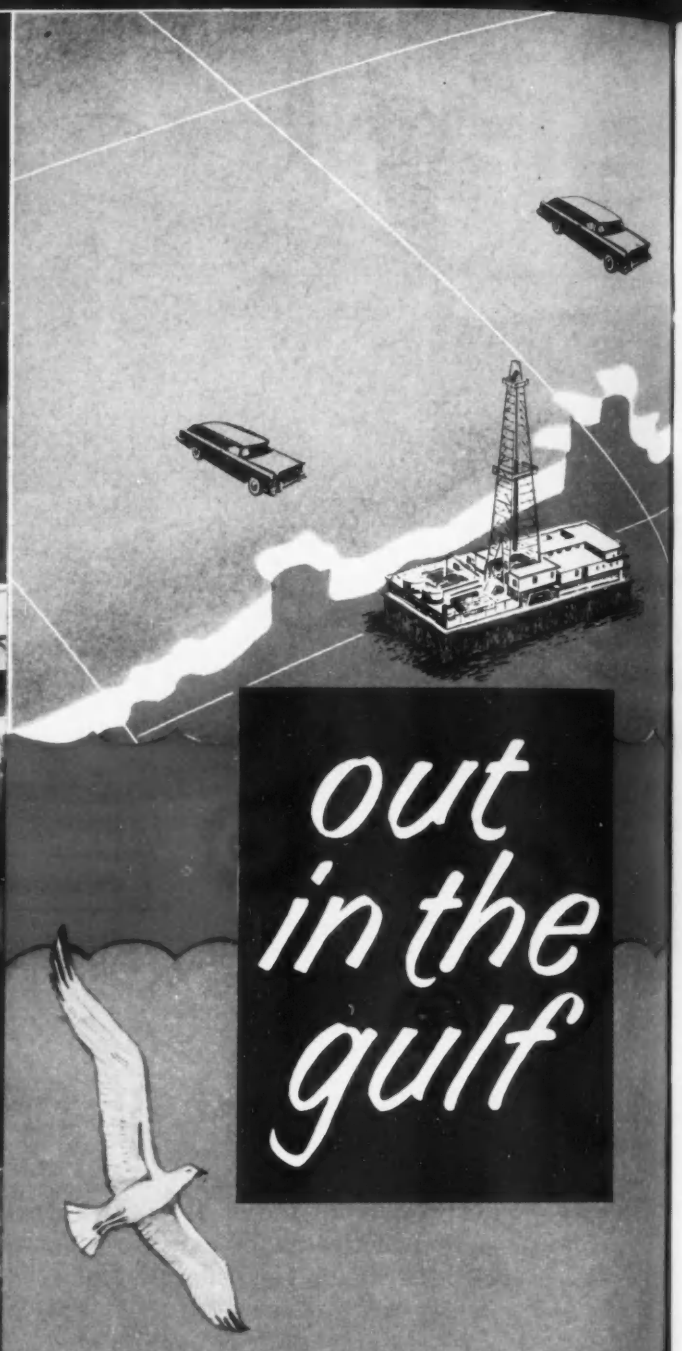
All in all, the new Allis-Chalmers HD-16 brings you an outstanding combination of performance and long life with both mounted and drawn equipment . . . a higher rate of production, more working time, more work done, LOWERED JOB COSTS.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.







out in the gulf

PARTS • SERVICE

STEWART & STEVENSON SERVICES

ANYTIME • ANYWHERE

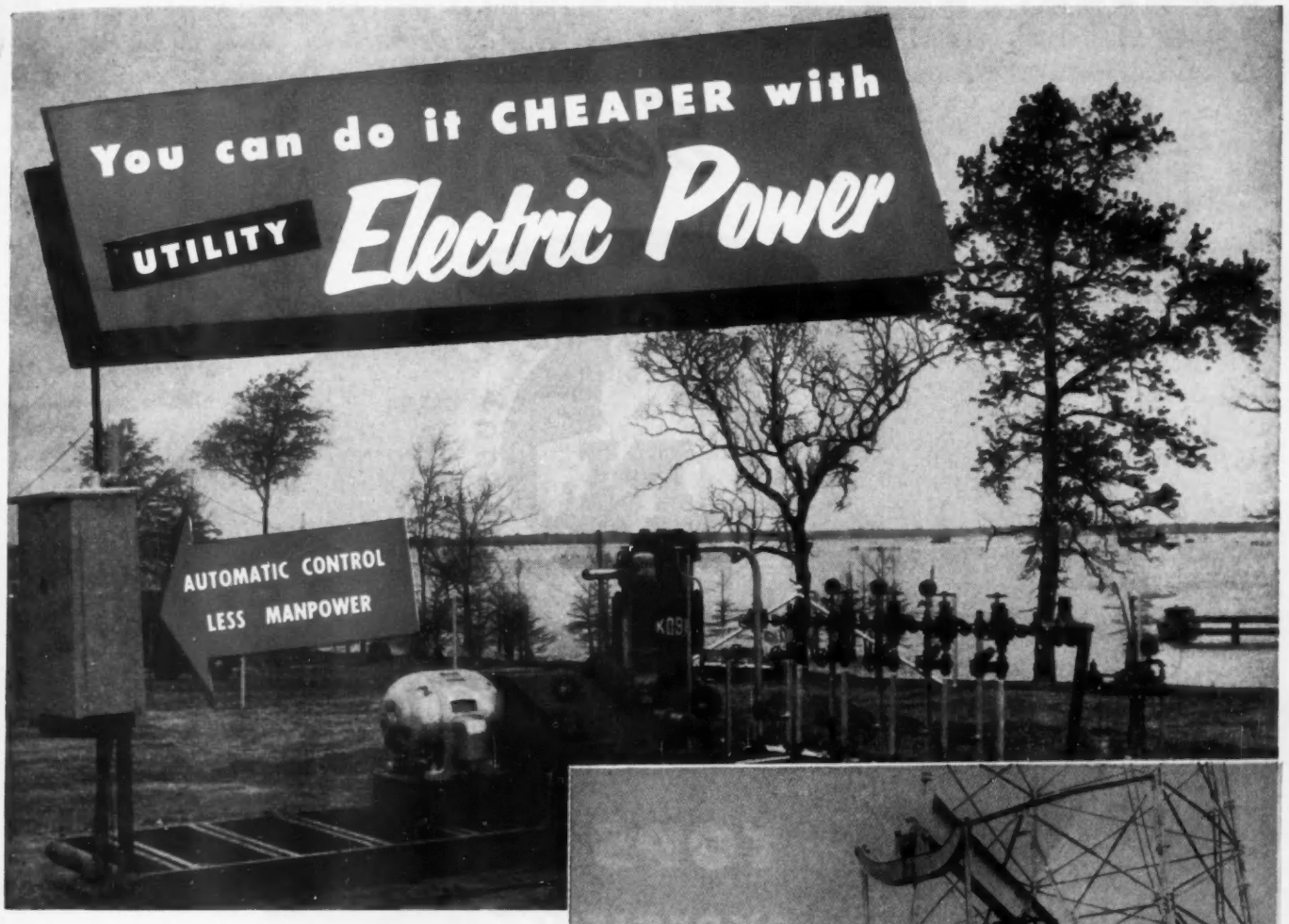
1 These three GM quad engines with a rated continuous horsepower of 520 each power a Southeastern Drilling Co. barge. A GM Diesel twin 260 continuous horsepower engine powers the 7¼" x 14" mud mixing pump on the rig and the two light plants are each powered by a single GM Diesel 6.71 engine.

2 Electricity on the "Mr. Gus" is supplied by four Model 12-GD160 Stewart & Stevenson Diesel Generator Sets.

3 The drawworks and compound on the "Mr. Gus" are powered with four Model 24103 General Motors Diesel Quad Units from Stewart & Stevenson.

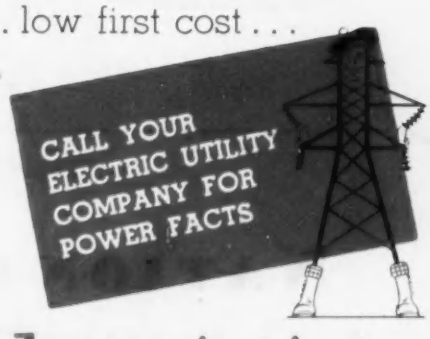
4 Here is a typical mud pump application using the 625 continuous horsepower Model 567-C General Motors Diesel Engine to drive an Oil Well 20 P mud pump.

*Glassecock Drilling Co.



For Big Jobs or Little Jobs-it's Utility Electric Power in Louisiana—

Oil Producers in Louisiana recognize the superiority of Low Cost Utility Electric Power for automatic, multiple or single well pumping. Electric power gives them advantages of low operating, maintenance and labor costs . . . low first cost . . . plus dependable, trouble-free efficiency. Analyze **your** power needs and then call your Local Utility Electric Power Company — they will show how Low Cost Electric Power will fill your needs.



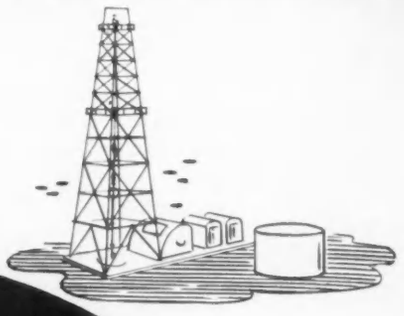
Petroleum Electric Power Association

P. O. BOX 2771, DALLAS, TEXAS

ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

TOPS IN OIL FINANCING!

See



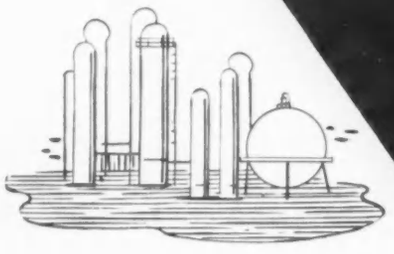
NATIONAL BANK OF TULSA

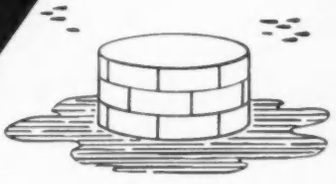
NBT

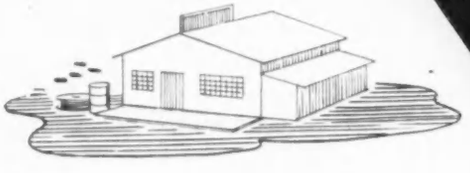
The Oil Bank of America

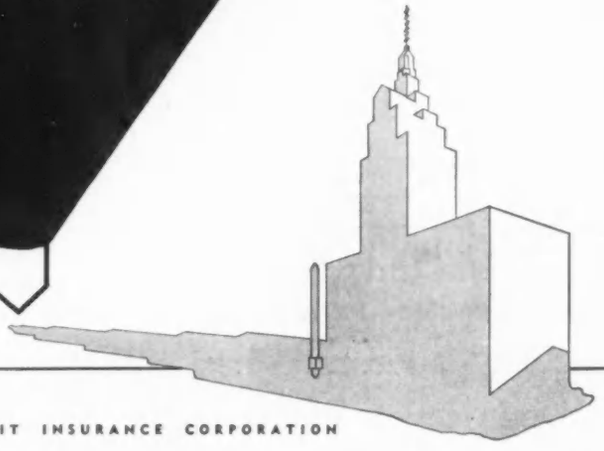
TOPS in

EXPERIENCE
FACILITIES
RESOURCES
LOCATION and
SERVICES









MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA

The Oil Bank of America

OFFERING COMPLETE BANKING AND TRUST SERVICES

Congratulations

to the expanding

Brazilian oil industry

On March 12, the Brazilian oil industry succeeded in bringing in its first well in Amazonas . . . thereby opening a vast new province in its expanding search for petroleum reserves.

The discovery well is located at Nova Olinda, on the Madeira River, nearly 1000 miles from the nearest producing well.

GSI is proud to have played a part in the search for Brazilian oil.

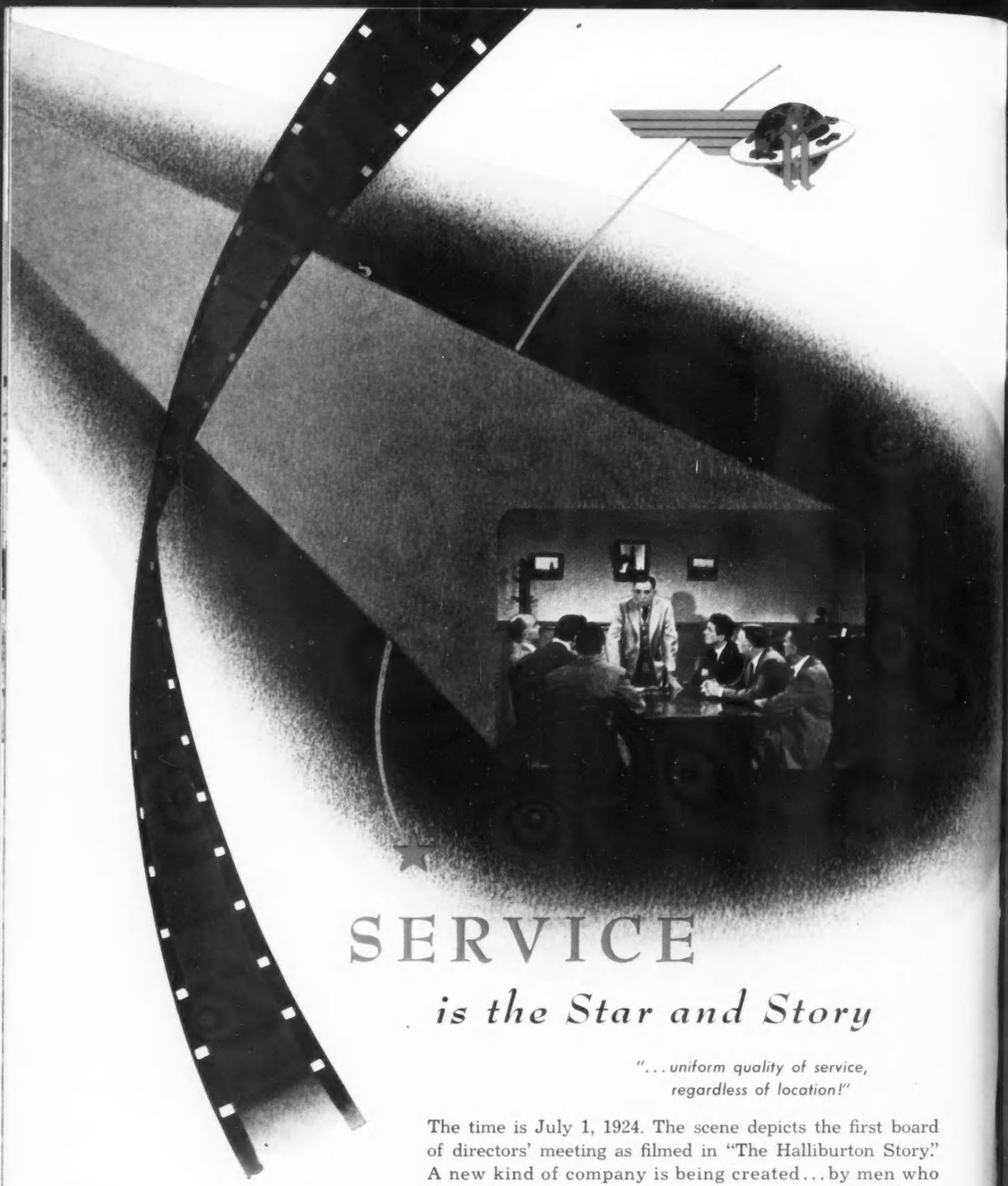
In Brazil, as in other major oil producing provinces throughout the world, GSI continues to provide traditionally high quality geophysical services in efforts to assist its clients in finding a world of oil.

1930 ☆ 1955 GSI 25TH ANNIVERSARY ®

GEOPHYSICAL SERVICE INC.

5900 LEMMON AVENUE • DALLAS 9, TEXAS

Finding a World of Oil for a Quarter-Century



SERVICE

is the Star and Story

"... uniform quality of service, regardless of location!"

The time is July 1, 1924. The scene depicts the first board of directors' meeting as filmed in "The Halliburton Story." A new kind of company is being created... by men who believe that business is more than a device for making money, that greater satisfaction comes from performing a service to the industry, service beyond the fee, service above all. Is it surprising that such a policy attracted more and more customers? Halliburton today is a world-wide service organization and the leader in its field. Service is still the star and story of Halliburton... and research is our most important service.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

PROGRESS IN SERVICE THROUGH RESEARCH

Drilling Section

From Tulsa to Teheran

TOTCO means Better Service

Better service, because of a complete distribution network that makes TOTCO equipment available wherever men are drilling for oil.

Better service, because day or night, in any weather, one of TOTCO'S highly trained field men is at hand–able and willing to help you.

Better service, made possible because more of you use TOTCO Recorders than all other makes combined.

TOTCO

Double Recorder

Be sure you know, use TOTCO

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United States Steel Company

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"...but I thought you guys were just steel men!"

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN
DRILL PIPE
MADE FOR OIL MEN
BY PIPE MEN

●At Youngstown we're not only steel men. We're pipe men, too. Our experience in the oil fields is first hand. We work with contractors. We know what they expect from drill pipe. We know their problems. And we produce quality drill pipe to meet those problems.

Youngstown Drill Pipe is furnished in a wide range of finishes, shrink-type, welded and A.P.I., to fit the specifications of all tool joint manufacturers. Our engineers will be glad to help you choose the string you need to give you the most hole for your dollar. Get in touch with your nearest Youngstown distributor. Or call your nearby Youngstown District Sales Office.

Youngstown DRILL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Roll out collapsed casing and liners with an

Eastman CASING ROLLER

The Eastman CASING ROLLER is the most efficient, effective and economical way to roll out collapsed casing and liners to their original gauge.

The body and rollers of the Eastman CASING ROLLER are made of specially heat treated steel, and the roller ends are tapered to prevent snagging. Continuous rolling surface minimizes friction and vibration. There is also circulation through the tool and around each roller.

These CASING ROLLERS are available in API sizes for casings with inside diameters ranging from 2½" to 17⅜". Other sizes made to order.

Call the Eastman office nearest you. Consult your telephone directory.

Eastman Oil Well Survey Company

LONG BEACH • DENVER • HOUSTON

Export Sales and Service:

EASTMAN INTERNATIONAL COMPANY

P. O. Box 1500 • Denver, Colorado, U.S.A.

EASTMAN OIL WELL SURVEY COMPANY — Eastman — 25th ANNIVERSARY — 1930 • 1955

you can bet the BLUE CHIPS

on drilling success when you use BAROID chemicals

Baroid chemical additives are the blue chip products of the drilling mud industry. Drillers everywhere rely on these Baroid chemicals specifically designed for mud success.

To control viscosity, gel strength, and filtrate, and overcome the harmful effects of contaminants, use these specifically designed Baroid chemicals:

ANHYDROX *(barium carbonate)*
BARAFOS *(sodium tetraphosphate)*
CARBONOX *(organic thinner and emulsifier)*
HYDROCARB *(alkaline-Carbonox)*
HYDROTAN *(alkaline-tannate)*
LIGNOX *(calcium lignosulfonate)*
MAN-TAN *(mangrove tannin)*
SMENTOX *(specific for cement contamination)*
TANNEX *(quebracho compound)*

Baroid's service engineer can determine the specific chemicals best suited to treat your particular mud to save drilling time and reduce total mud costs. Specify Baroid chemicals.

BAROID

BAROID P. O. Box 1675, Houston 1, Texas

Please send me the latest technical information on Baroid chemicals.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

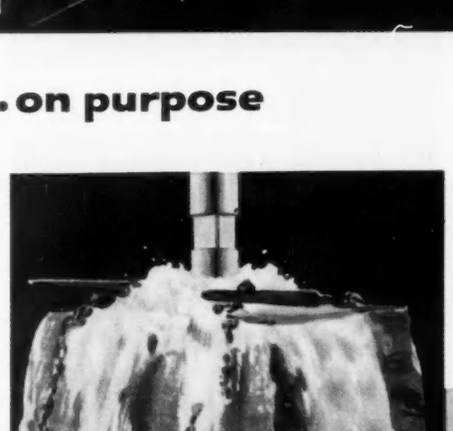
CITY_____ ZONE_____ STATE_____

BAROID

BAROID DIVISION • NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

We drill dry holes . . . on purpose

We drill our "dry holes"—hundreds per year—in the research laboratory . . . and they *produce* better rock bits . . . bits that enable you to drill wells faster and more economically. We drill these "dry holes" to test bit designs and materials under simulated field conditions. Facts learned from these HUGHES tests have helped to produce bits that are saving days in drilling wells and have made it possible to drill areas that otherwise would not have been drilled. Our "dry holes" have played an important part in aiding the producing industry to add billions of barrels to the oil reserves.



HUGHES
TOOL COMPANY
HOUSTON, TEXAS
WORLD STANDARD
OF THE INDUSTRY

Why replace tool joints ?

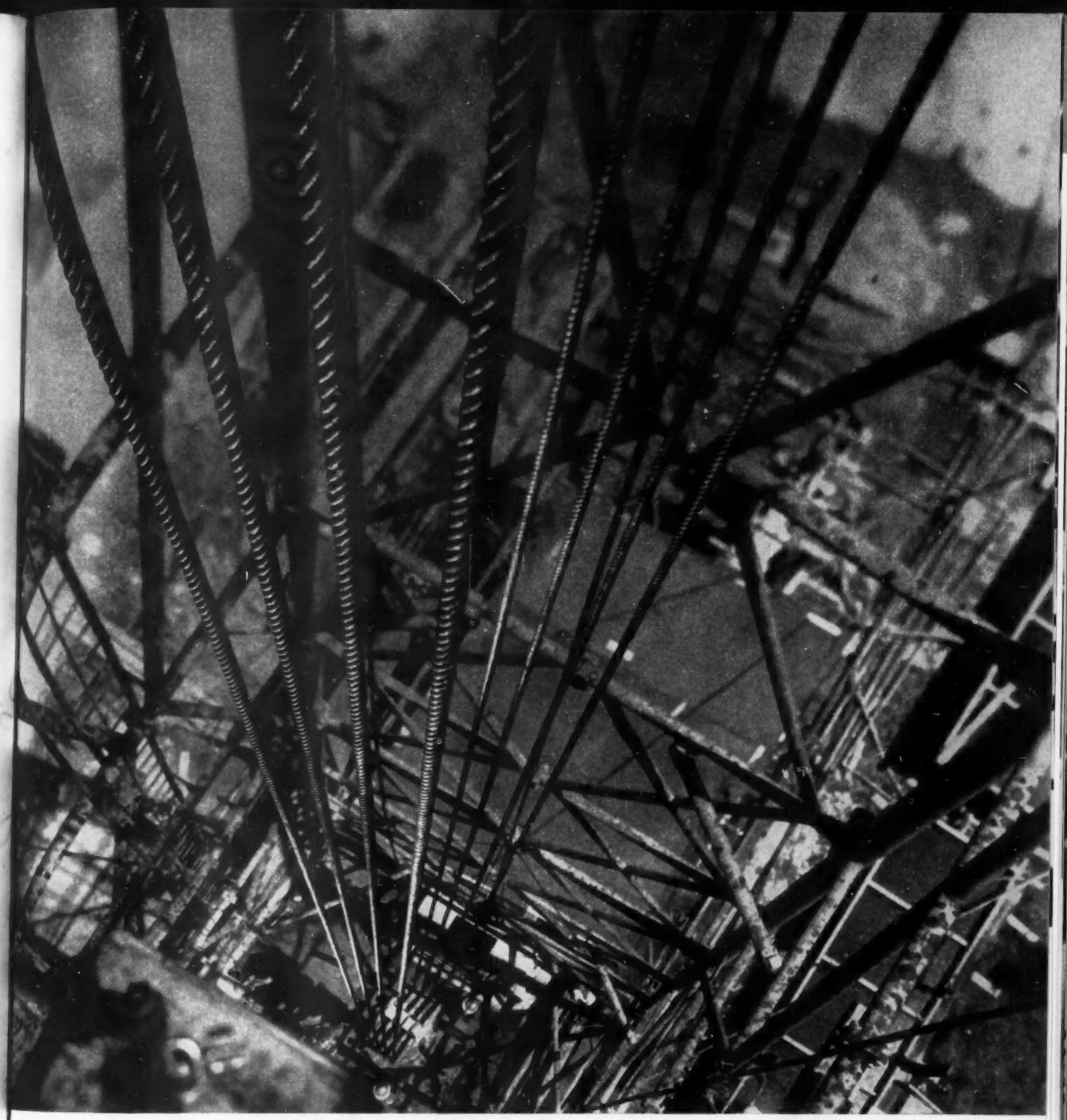
You can avoid the expense of replacing tool joints by unitizing your drill stem with HUGHES *Flash-Weld* Joints—built to last the life of the drill stem.

This is true even where abrasive conditions are encountered. To meet this type of service, HUGHES hard-faced joints are recommended. For extreme abrasive service these same joints can be rehard-faced in the field, using hard-facing techniques developed by Hughes.

Operating records show that drill stem costs per foot of hole drilled are lower when HUGHES *Flash-Weld* Tool Joints are used.

HUGHES *Flash-Weld* is the *original* integrally welded tool joint—proved on more than 32,000,000 feet of drill pipe and in 17 years of service.

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS



Wire Rope at Work—This was a workover job in a field where dual completions are often required. The well was better than two miles deep, and the rig had its work cut out for it. Not only did the job demand more trips than usual, but it was sometimes necessary to pull stuck liners. When stubborn conditions developed, the rig components were in for a tussle.

Because unusually high stresses were common, the contractor selected Bethlehem Purple Strand for his wire rope needs. He decided upon 1⅛-in. Form-Set (preformed) 6 x 21 Seale, and also specified independent wire rope core for maximum resistance to crushing. This combination proved exactly right for the job, which was tough enough to test the mettle of any rig—and any rope.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

PETROLEUM • MINING • CONSTRUCTION • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING

You can tell when

Nothing but the finest will bear the name of

SLUSH PUMP VALVES • VALVE SPRINGS • VALVE SEAT PULLERS • **PISTONS** • PISTON RODS

Every forty minutes of every working day Core Lab begins another job . . . faces another problem created by the inconstant physical characteristics and productive behaviors of hydrocarbon-bearing formations. And to accept and adequately resolve these economically critical responsibilities demands far more service than routine reporting of mechanically-procured information.

Each set of basic data must be balanced against the logic of past experience and blended with the benefits of new, imaginative research in petroleum reservoir engineering.

When a final Core Lab core analysis report and interpretation is delivered it represents the finest combination of procedures, experience, and research available to the industry today. Each comprehensive evaluation is developed under the direct supervision of a permanent area-resident engineer. He, in turn, has at his fingertips the added field experience of 31 other Core Lab installations, plus the technical advice of Core Lab's Research Department and Special Core Analysis Studies Section.

As the search for new oil uncovers new problems, each formation cored deserves this quality of analysis work.

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PETROLEUM RESERVOIR ENGINEERING

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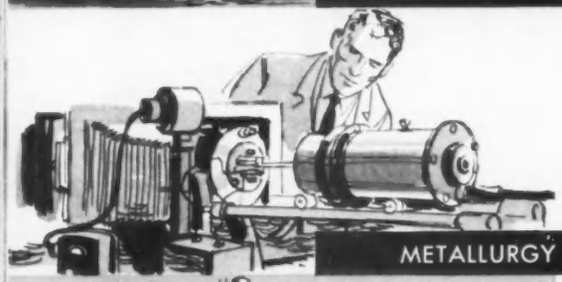
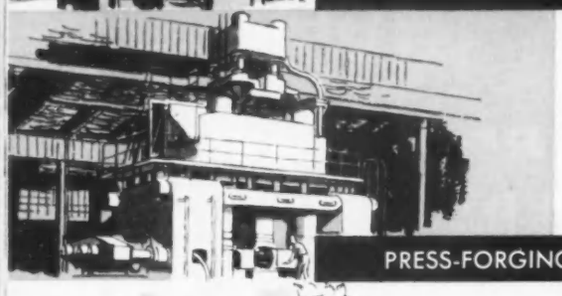
STEEL MAKING

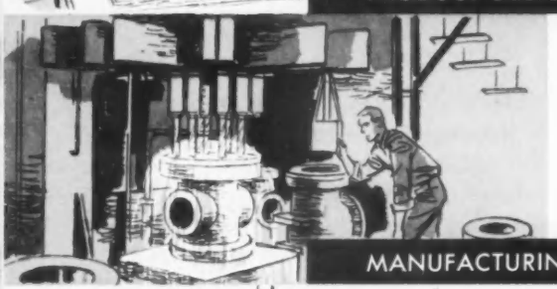


METALLURGY

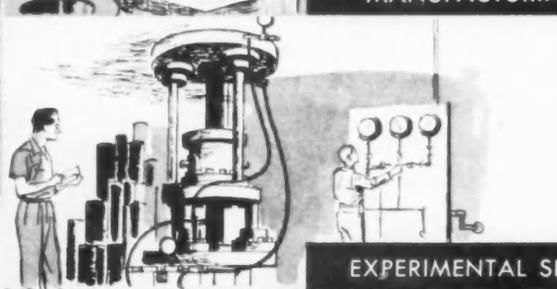


PRESS-FORGING

PRODUCT DESIGN



MANUFACTURING



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STOCK AND SHIPPING

MEN AND METHODS NEED THE BEST EQUIPMENT FOR THE BEST RESULTS

Cameron has **gone all the way** to make every product bearing the Cameron name outstanding. Designed to do a specific job better; engineered for all-around safety and economy; and quality controlled by completely integrated manufacturing facilities, Cameron equipment is sure to bring out the best in your men and methods.

Cameron

IRON WORKS, INC.

P. O. Box 1212, Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: British Oilfield Equipment Co., Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

THERE ARE MORE TON-MILES

IN EACH REEL OF

Yellow Strand®

WIRE ROPE

With longer, heavier strings of drill pipe, drilling costs are going up. But your wire rope costs can be held down . . . with Yellow Strand rotary lines.

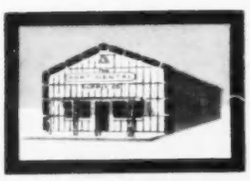
A reel of Yellow Strand Wire Rope gives more ton-miles of service. Order that one reel of tough, flexible Yellow Strand from your nearby Continental store — the next time you string-up — and join the long list of consistent Yellow Strand users!

FAST SERVICE . . .

is another Yellow Strand feature. Continental Supply Company stocks Yellow Strand — in the grades, sizes and construction you need — at each of its convenient stores. Phone your order for immediate attention.

CONTINENTAL

Serving the Oil and Gas Industries



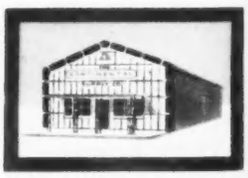
THE CONTINENTAL SUPPLY COMPANY

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

THERE'S NO MAGIC IN NEW BEDFORD ...IT'S JUST THE WORLD'S BEST ROPE

If there could be magic in rope, New Bedford would have it! The only performance claim for this pure manila cordage is day-in, day-out dependable service with longer life under severest treatment. "There's None Better" than New Bedford. At your Continental store.



THE CONTINENTAL SUPPLY COMPANY

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

CONTINENTAL

Serving the Oil and Gas Industries

Production Section

Somebody is about to get the best service in the field

Here's a picture of a situation that happens every day. A telephone call from a user of O-C-T Equipment . . . and the O-C-T Service Organization gets in high gear.

As a result of its continuous expansion program during the past six years, Oil Center Tool Company now has the largest service organization in the field to help you set and service wellhead assemblies.

At present, you will find O-C-T service within a stone's throw of your operations throughout Texas, Louisiana, Oklahoma, Mississippi, New Mexico, the Rocky Mountain area, Canada and Venezuela.

There comes a time on every job when good service from your equipment supplier can save you money. And you'll be dollars ahead when you switch . . . and standardize . . . on dependable O-C-T equipment. It's available through more than 700 supply store points.

O·C·T

OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

Export Representatives: Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

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SUPPLY BOVAIRD COMPANY

DOWNTIME?

THAT'S THE LEAST OF MY WORRIES WITH A BOVAIRD STORE CLOSE BY

TO GET WHAT YOU WANT
WHERE YOU WANT IT
WHEN YOU NEED IT . . .
AT REASONABLE
COMPETITIVE PRICES

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THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

84 YEARS OF PROGRESS WITH THE OIL INDUSTRY

R. Lacy, Inc., Frost Hull Station, Carthage, Texas — equipped with one 440 h.p. 8SVG and one 550 h.p. 10SVG Beaird-Ingersoll-Rand four cycle gas engine driven compresso plants with Young radiators and all necessary controls. Other sizes 110 to 660 h.p.

R. LACY, INC., has planned its Frost Hull station to utilize to the fullest the flexibility of operation possible with packaged compressors. Boosting gas from nearby Carthage, Texas, fields into a sales line, the station was initially equipped with a single 8SVG 440 h.p. Beaird-Ingersoll-Rand packaged compressor plant. The original piping of the installation included connections for the addition of a second packaged unit should wellhead pressures continue to drop off. A year later a 10SVG 550 h.p. Beaird-Ingersoll-Rand packaged compressor was added.

Now operating with single-stage compression, the units pick up gas at 475 psig and boost it to 1,175 psig for delivery to the line. Should wellhead pressures continue to decline, a third unit could be added to the station or the existing units changed over to two stages of compression. Later one of the units could be transferred to other service leaving the remaining plant to complete production. Requiring a minimum in the way of foundation and connecting piping, the entire compressor installation will be almost wholly salvageable when moved.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements.

Handle Pressure Drop Off—

FLEXIBLE INSTALLATION MADE WITH PACKAGED COMPRESSORS

THE J. B. BEAIRD COMPANY, INC.

Shreveport, Louisiana

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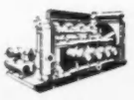
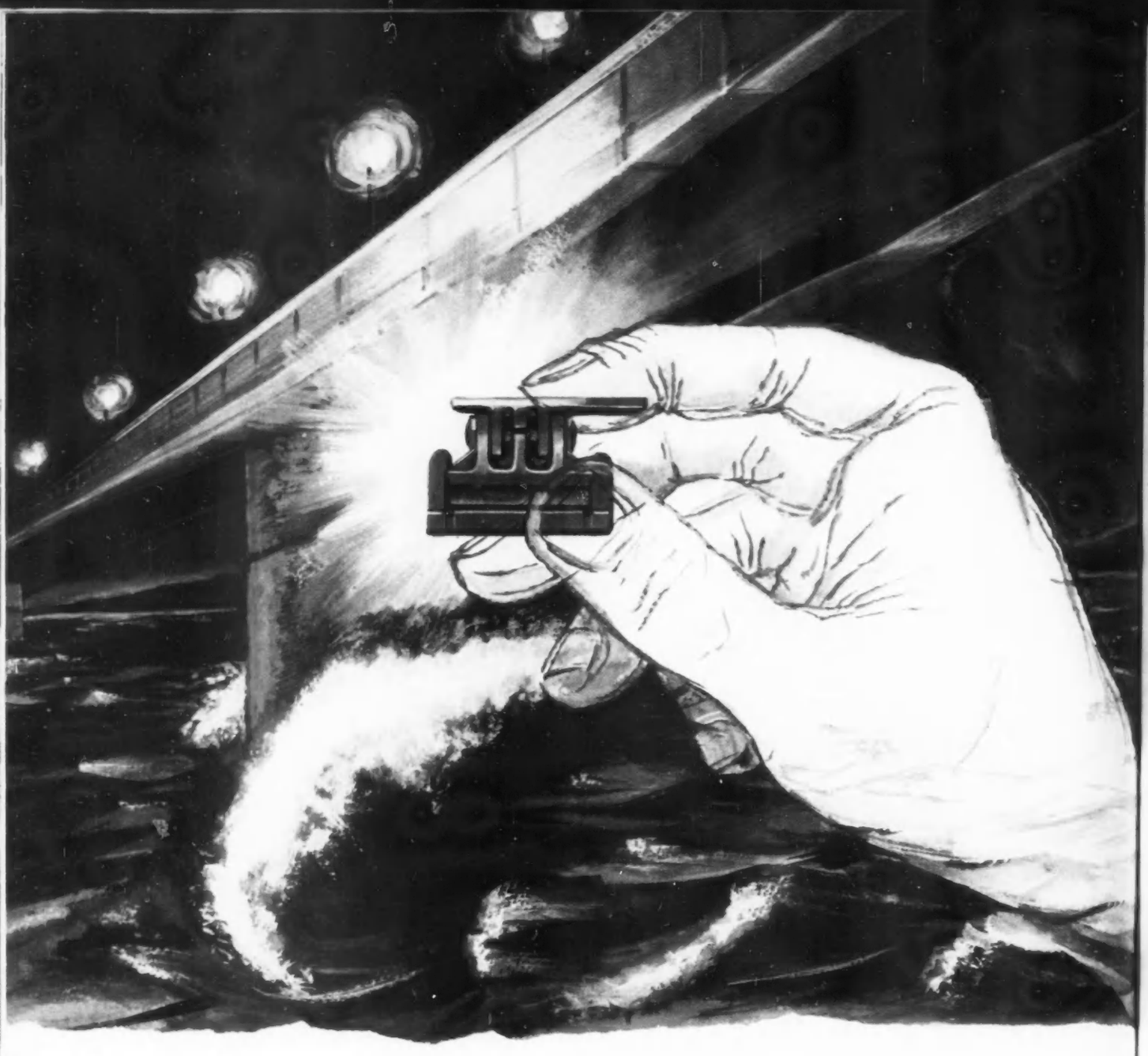

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS



SHOES for a bridge that walks

LITERALLY PACING BACK AND FORTH on its foundation as it reacts to heat and cold, this giant bridge across the Red River was fitted with massive shoes of steel — made by Beaird's machining division. Well known in the oil and gas industries for packaged compressor plants, pressure storage vessels and cast steel fittings, Beaird has an equally wide-spread reputation as a dependable source for contract machined and fabricated parts and sub-assemblies.

The walking bridge is only one of the many engineering achievements that Beaird's versatile machining division is helping to build. One of five manufacturing divisions at Beaird, the machining division brings to its customers the integrated resources, facilities, experience and skills of all five Beaird manufacturing divisions.

Let us show you how Beaird can offer you dependable production on your product . . . at lower cost . . . by writing The J. B. Beaird Company, Inc., Shreveport, Louisiana.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

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IVERSON SUPPLY COMPANY'S stores pride themselves on filling the needs of their customers completely and with greatest speed. Back of the products is the integrity of the manufacturer and a guarantee of satisfaction. With this is the long years of experience of IVERSON representatives under practically all oil industry conditions. Their advice, based on knowledge and sound judgment, is part of our company's service.

WHATEVER YOUR REQUIREMENTS CHECK WITH IVERSON FIRST

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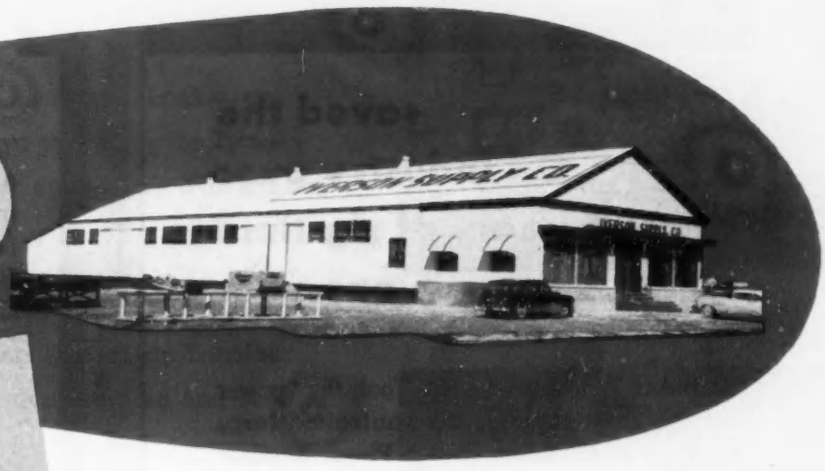

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It takes all three

to get results—

1 THIS SETTING TOOL

saved the Oil Industry over 4 years of rig time ...*in one year*

The Baker Wire Line Setting Tool, the "power package" that supplies the controlled force necessary to set Baker Bridge Plugs, Retainer Production Packers and Cement Retainers on wire line, brought *dependable, time-saving* wire line bridge plug and packer service to the oil industry.

This tool brought together (a) the established performance of Baker Bridge Plugs and Packers with (b) the highly efficient wire line service organizations, thus providing operators with a dependable source that saved the oil industry an estimated four years of rig time *in one year.*

2 THESE WIRE LINE SERVICE COMPANIES

RUN A BAKER BRIDGE PLUG, RETAINER PRODUCTION PACKER, OR CEMENT RETAINER ON WIRE LINE, EVERY FORTY MINUTES DAY AND NIGHT, AROUND THE CLOCK... *AROUND THE WORLD.*

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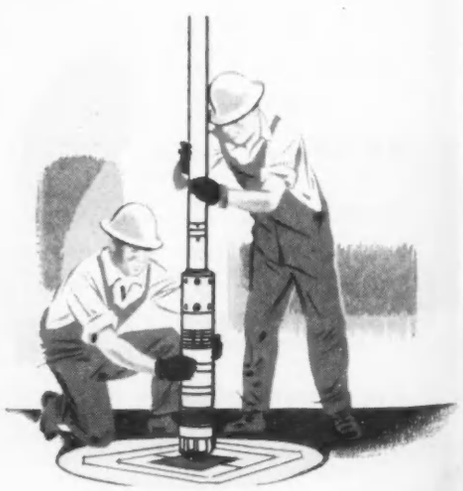
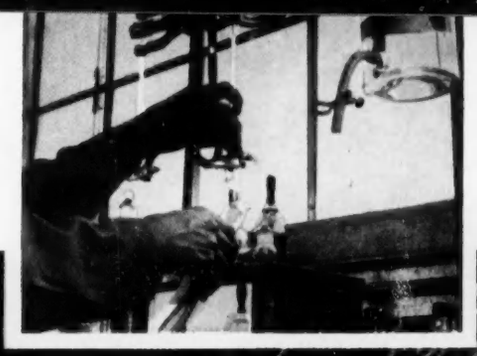
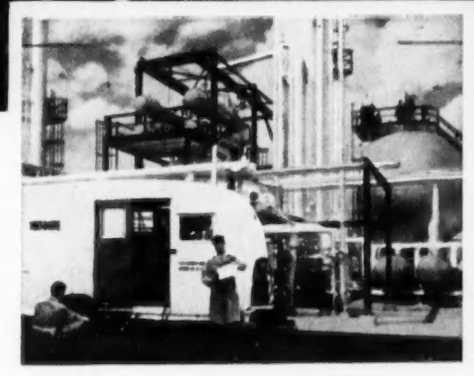
The Western Company

The combined trained personnel of these companies comprises a service organization with over 1,000 men in the field. Nearly 400 service locations ensure maximum availability of Baker Wire Line Bridge Plugs, Packers and Cement Retainers.



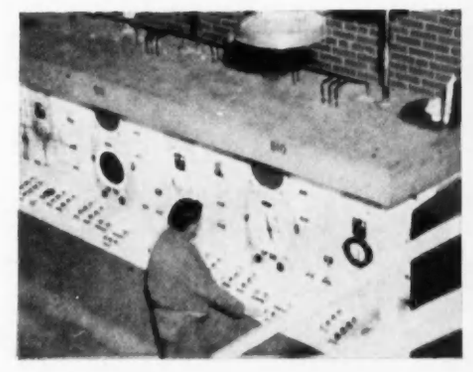
they keep coming





New formulas — new answers to oil industry problems — developed in Tretolite laboratories, tested and proved by the Tretolite field development staff and expertly applied by Tretolite service engineers.

This solid approach has been routine at Tretolite for many years. The results provided for Tretolite customers have made Tretolite products the standard for comparison in demulsifying and corrosion inhibiting practice.



Want convincing proof?
Just call the Tretolite engineer in your area.

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A DIVISION OF PETROLITE CORPORATION

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with PAGE*

Sucker rod ON and OFF attachment

1 *RUN IN YOUR PUMP ON THE TUBING*

2 *EASY RELEASE IN CASE OF SANDED-UP PUMP*

3 *FISH BROKEN RODS WITHOUT PULLING PUMP*

This highly developed PAGE ON AND OFF ATTACHMENT assures quick and easy connection or disconnection of sucker rods at the pump. It provides for easy removal and replacement of sucker rods without disturbing the pump plunger.

To operate, run the pump in on the tubing with the lower end of the PAGE tool in place. Then lower the rods with the matching ends of the tool attached. When the two sections of the ON AND OFF ATTACHMENT meet, turn right and lower to engage. Then a turn to the left will lock the two sections together.

To disconnect, lower the rods, turn right to the radial stop and pick up.

By means of this tool you can run pumps larger than the size of the tubing. Also broken sucker rods can be "fished" without unseating the pump or dumping the fluid.

The tool is rugged and simple in design—no complicated mechanism to offer trouble. Both the spear and socket sections of this PAGE ON AND OFF TOOL are milled with nine extra-heavy lugs to support the load and to assure long life.

Made for all sizes of sucker rods.

TOOL ASSEMBLED

*Registered U. S. Patent Office.

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THE NAME TO LOOK FOR ON OIL TOOLS

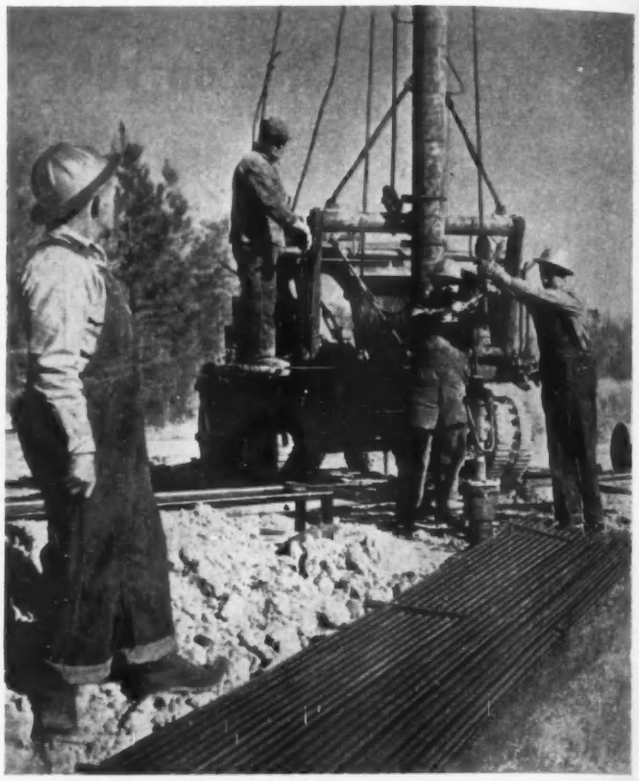
Pumping Liquid Gold in Southern Arkansas

They never lack for activity in the Hibank field, near El Dorado, Ark. In this field, and in adjacent areas, Caddo Oil Company is operating more than one hundred producing wells, in many of which Bethlehem Sucker Rods are playing an important part. The accompanying photographs show one of these wells, the Risinger No. 4, equipped with 2100 ft of Bethlehem ⅝-in. "X2" sucker rods. This well is one of a recently completed 20-well program in the field, and is now producing 41-gravity oil.

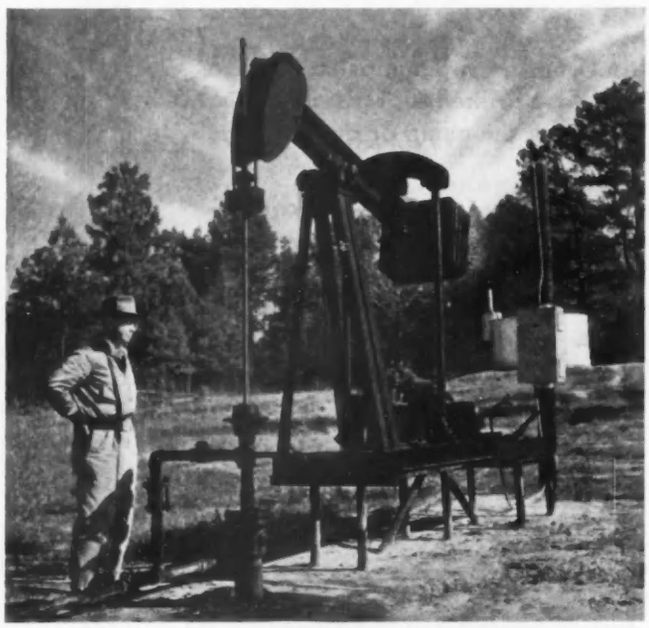
Bethlehem "X2" Rods are made of carbon-manganese steel. They are fully normalized to provide uniform mechanical properties, and are intended for medium to heavy pumping duty in generally non-corrosive wells.

No matter what type of well condition you may encounter, you can be sure of dependable service from Bethlehem Sucker Rods. For these quality rods come in carbon and alloy steels in types to meet individual requirements. For details, your sucker rod distributor is as near as your telephone. Or get in touch with the nearest Bethlehem sales office.

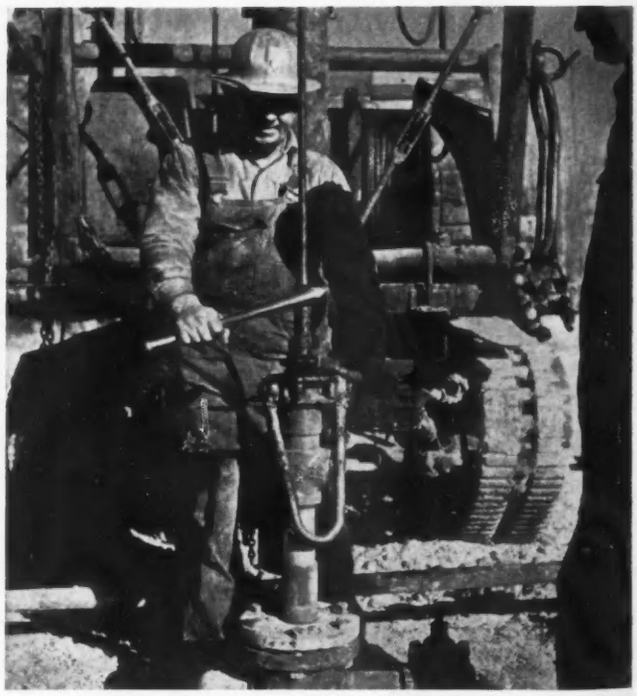
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Running the rods. Using servicing unit, workers guide Bethlehem "X2" rod into place. A Bethlehem unit package, which can contain 80 or 100 rods, is shown opened in foreground. It saves time, and prevents rod damage.



D. A. Raymond, Jr., president of Caddo Oil Company, studies Bethlehem pumping unit. This well has pumped with original equipment since completed in October, 1950.

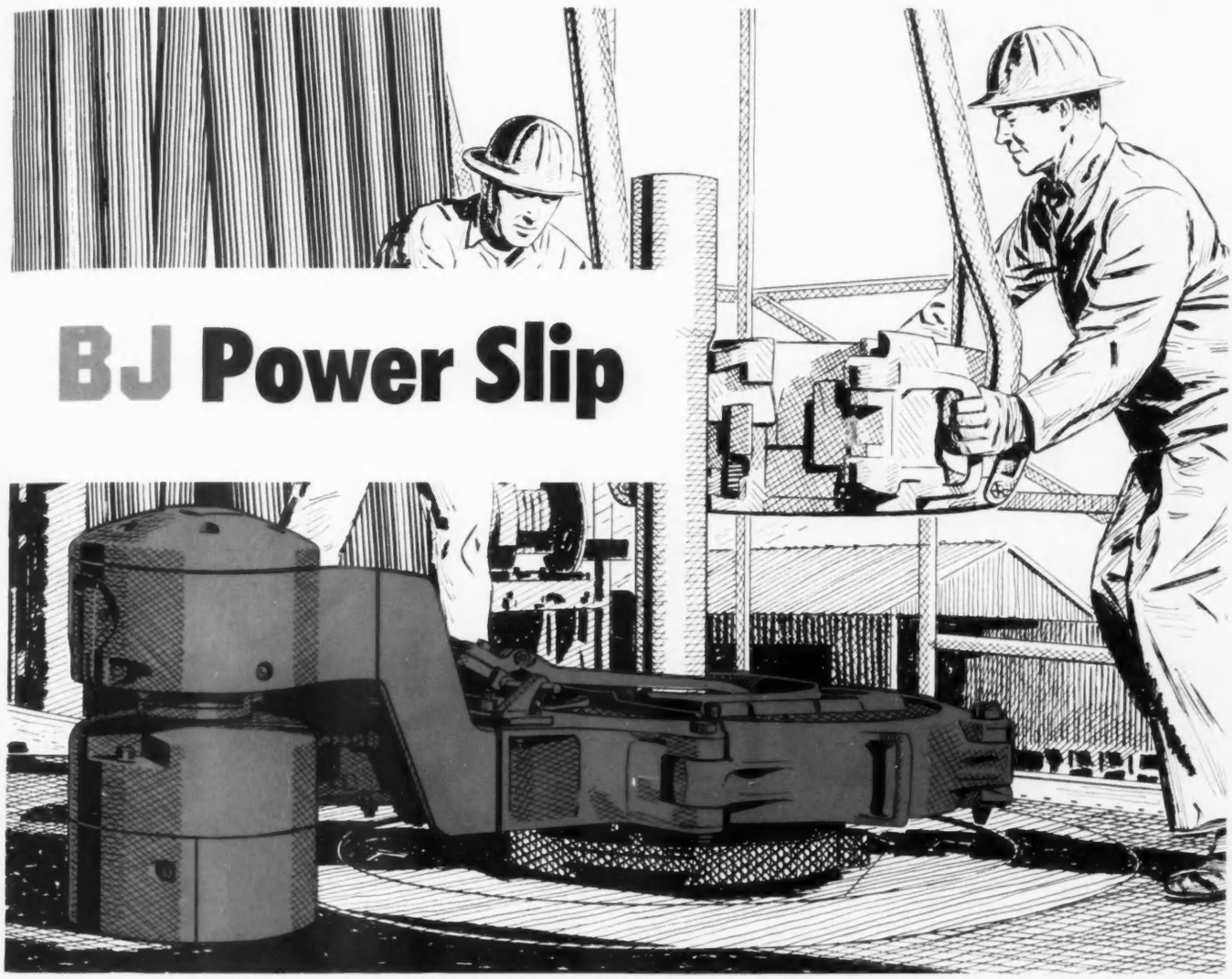


Using snap wrenches, joint is checked for tightness. Bethlehem "X2" rods were used as Risinger No. 4 well pumped 41-gravity oil from 2100 ft.

BETHLEHEM *Sucker Rods*

BETHLEHEM STEEL

International Section



BJ Power Slip

Two *new* safety features protect pipe and equipment

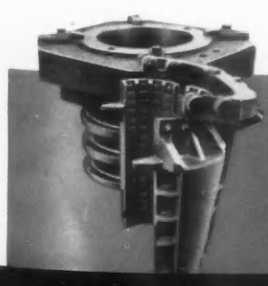
More power, more speed *and now more safety*—these are the exclusive advantages that make it even more profitable to handle pipe or casing with the improved BJ Power Slip.

NEW SLIP SETTING DEVICE prevents damage to equipment or loss of a string of pipe by automatically lowering and setting slips when the elevator touches the setting trigger. This guards against damage to the slip arm ring.

NEW SAFETY SIGNAL alerts the driller if he attempts to raise the slips before the elevator has picked up the string. While a load is on the slips, any movement of the "UP" control pedal sounds a warning whistle. Both the SLIP SETTING DEVICE and SAFETY SIGNAL are optional on new BJ Power Slips and can be quickly added to all BJ Type "B" Slips now in service.

Check now all the time-saving, cost-cutting advantages of the BJ Power Slip. With new safety features... fast action side opening... automatic pressure centering... ample working space... and unitized construction that allows permanent installation with the rotary table... it pays to put BJ Power to work for you!

For full information on more profitable pipe handling, call your nearby BJ field Sales Engineer. Or write today to:



Greater Versatility... with Less Cost

The BJ Casing Bowl, with extra-long slips and special carrier, economically adds to the versatility of the BJ Power Slip by extending load capacity to 300 tons and casing ranges to 13⅜".

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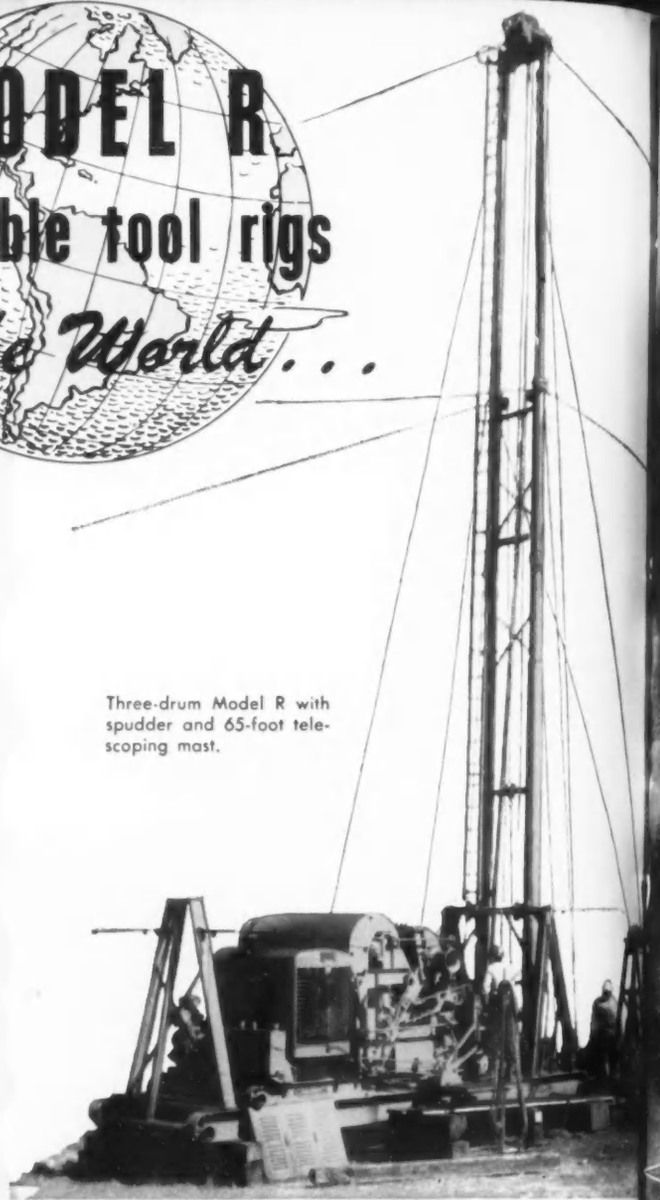
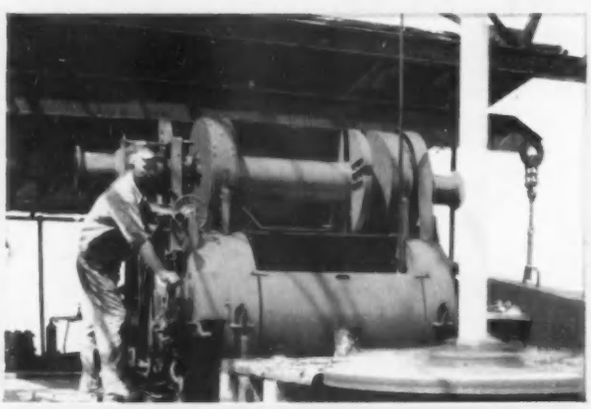
combination rotary and cable tool rigs

are the Standard of the World . . .

This Cardwell rig can be used on every kind of drilling, servicing, and workover job. The basic double-drum hoist can be equipped with rotary drive, spudder, third drum, or beam assembly, and is available in two sizes for rotary drilling to 5,000 feet, cable tool drilling to 7,500 feet, servicing and workover jobs to 10,000 feet. Write for complete information, or see your nearest Cardwell representative.

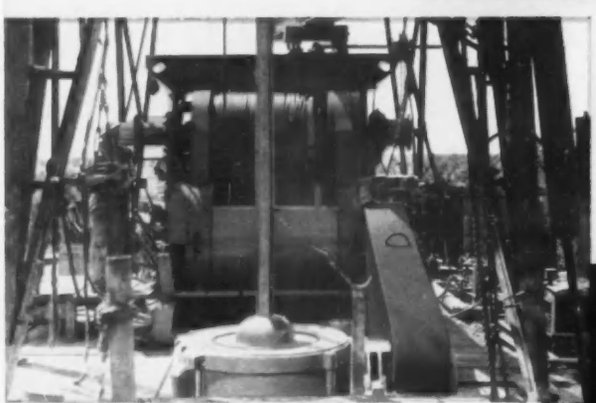


Three-drum Model R with spudder and 65-foot telescoping mast.



Rotary drilling with 4½-inch drill pipe to 4,859 feet in Oklahoma.

Double drum with spudder and 65-foot telescoping mast on drilling-in job.



Model R equipped with both beam assembly and rotary table drive doing rotary drilling. With no change in equipment, this outfit can immediately switch to cable tool operations, making it the most versatile rig in the world.

"Drill in" your wells with cable tools to insure a well in low-gas pressure areas. This practice is as "old as the hills," but it's still good procedure.

In wildcat territories, a Cardwell combination rotary and cable tool rig will lower your initial investment. After the drilling program is finished, the same rig will serve year after year as a workover rig for both rotary and cable tools.

There is a Cardwell representative and a parts stock dealer near you. Write or wire Cardwell Mfg. Co., Inc., Wichita, Kansas, for name and address.

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This location could be in California, Oklahoma or any other oil producing area . . . because there is one thing common to every drilling location in North America: prompt Magcobar drilling mud service. And Magcobar engineers gladly accept the fact that oil well drilling is a 24-hour a day business.
Year after year, Magcobar has trained and equipped scores of additional field engineers to help with your drilling mud problems. Every year, Magcobar has continued to improve and add new products to meet specialized conditions. Today, you can get the best field mud engineering service . . . from Magcobar . . . that has ever been provided to the oil industry.
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Complete
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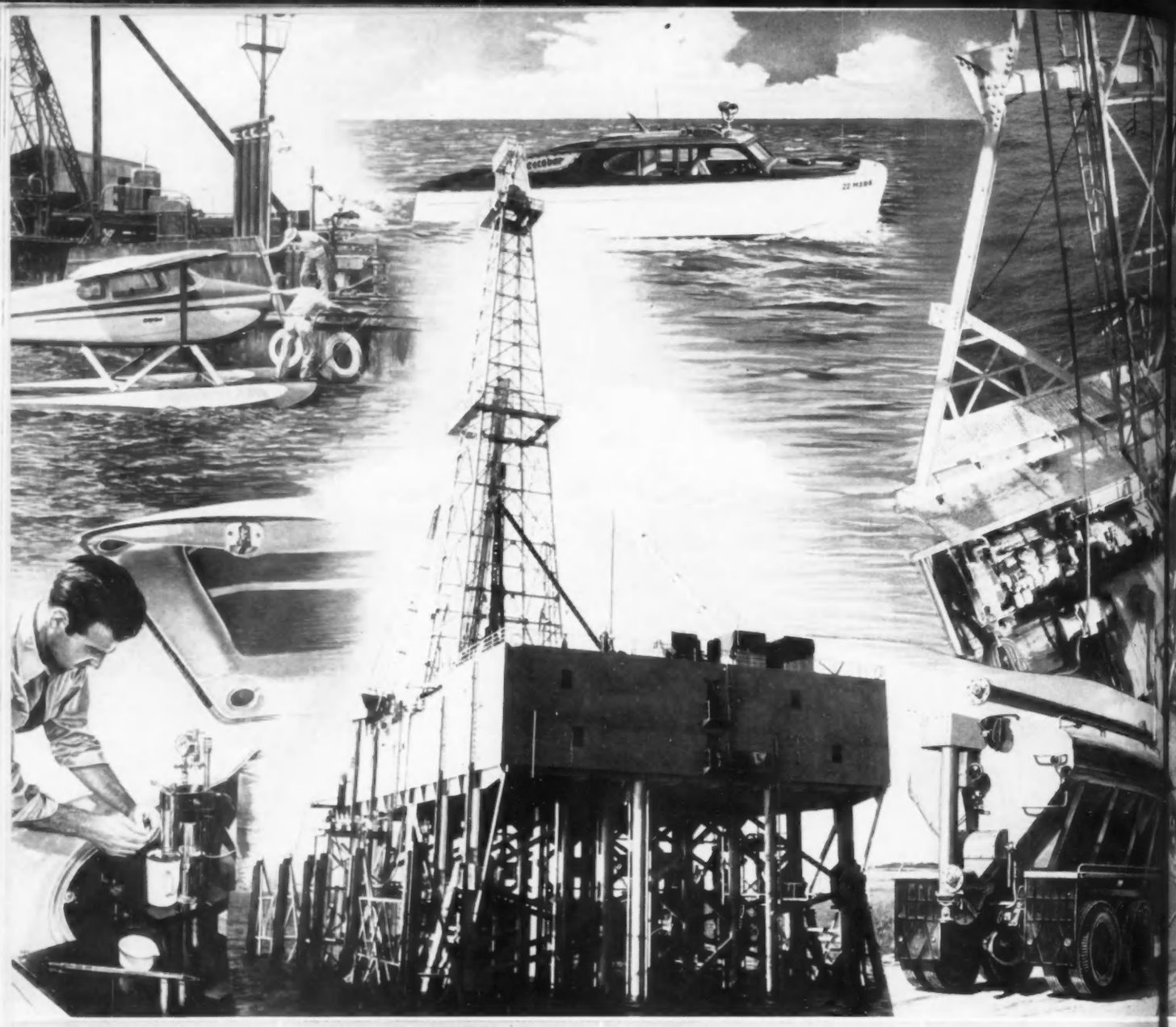

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the mud with the extra quality

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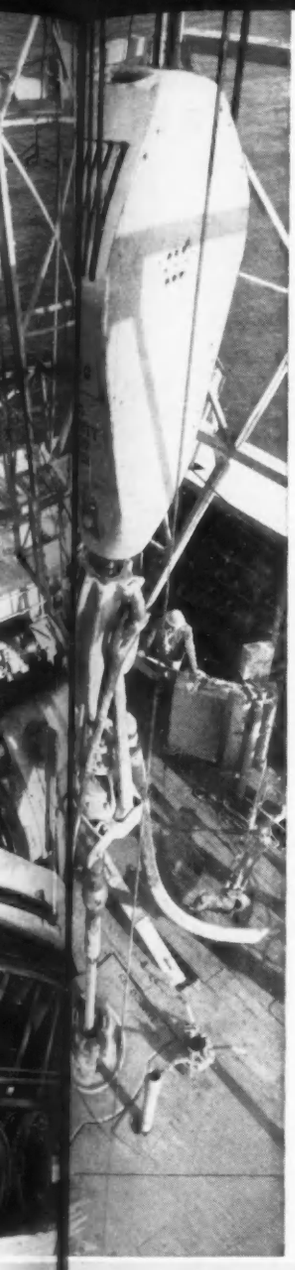

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Offshore drilling takes ocean-going experts. Magcobar drilling muds and Ideco drilling equipment are a seaworthy team bringing the Dresser Plus + to Kerr-McGee's rig No. 44 off the Gulf Coast. Carefully developed suspending and sealing properties and high quality standards make Magcobar drilling muds *extra* dependable for economic, efficient drilling... anywhere. To supply offshore locations with specially packaged mud additives, Magcobar and its dealers operate an extensive barge fleet along the Gulf Coast. Ideco equipment on the big Kermac rig includes Airflo 1350-S rig, Hydrair H-35-S rig, 400-ton Big Shorty block, 300-ton Streamlined swivel, Streamlined oil-bath rotary, two Clark-Ideco T-880 slush pumps, and driller's console.

The Dresser Plus + is the *extra* plus value you get when you are served by any one of the Dresser Industries. Operating independently to assure maximum attention to your specific needs, these Dresser companies work together to provide a versatile group of research, engineering and manufacturing services. On land or sea... Dresser oil, gas and chemical equipment and services are the standard of comparison the world over!

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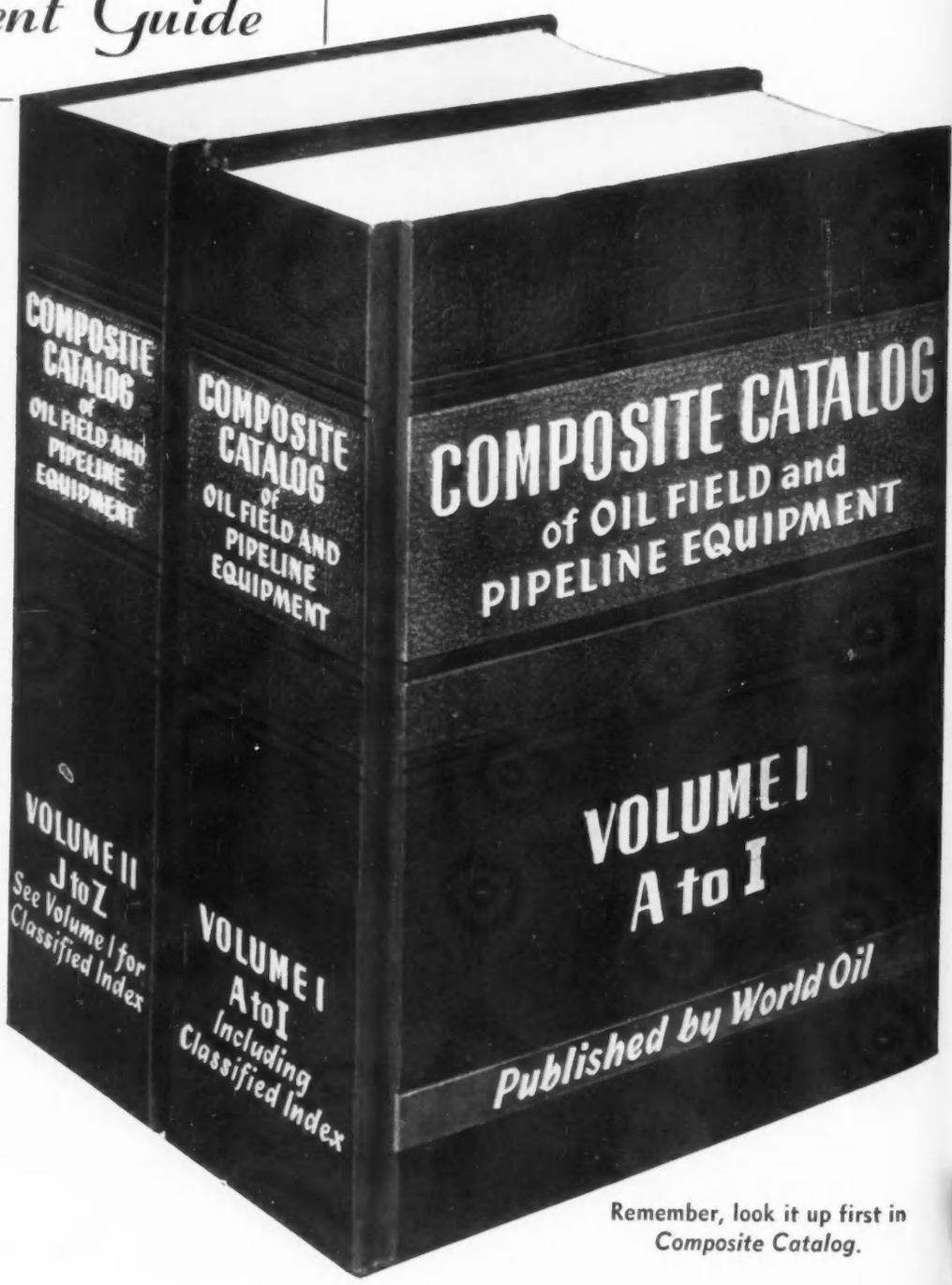
For two decades, *Composite Catalog* has been the very "equipment bible" of oil field buyers. Indexed by both company and product name, the current 5,200-page edition is made up of the combined catalogs of hundreds of manufacturers having a common market in the oil producing and pipe line industry.

Wherever oil is produced or sought, this catalog is accepted as the standard source of buying information. You will save time and avoid errors by identifying the equipment as per page and figure numbers in *Composite Catalog*.


COMPOSITE CATALOG of OIL FIELD and PIPELINE EQUIPMENT
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VOLUME I A to I Including Classified Index
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Safety CASING HANGERS

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Years ago we set out to cut the high costs of oil well drilling, not just in theory but in practice; not just in pennies but in thousands of dollars. The wasteful overlapping of casing and how to eliminate it took our eye so we set out to whip it. RESULT: Today you find Burns Casing Hangers all over the world saving millions of dollars in casing cost and make-up time.

With the Burns Hanger you suspend the casing in tension—casing won't sink in the formation, buckle or bend into cavities. Slips bite sharply into the casing at the setting depth and stay there—100% full bearing slips instead of the old 2 point cone type prevents slip breakage. Lead seal below the slips won't set going in the hole—won't jam the slips upon retrieving. Weight of the oil string compresses the lead seal on setting, forming a perfect and permanent lock to the casing—no safer method has ever been devised.

Thousands of Burns Hangers are now in use in every field, at every depth; by independents and majors alike. We're extremely proud of the Burns line of hangers and only now after years of successful field experience are we beginning to broadcast this story through world-wide media.

Burns Hangers are available in all popular sizes. Prices upon request. Please give size, weight and the thread connection of oil string, and also size and weight of casing in which you set hanger. Check with us direct or consult a Burns Distributor.

BURNS TOOL CO.

8436 Salt Lake Avenue Bell, California

DISTRIBUTORS:

M. D. Rehders
Post Office Box 396
Farmington, New Mexico
Telephone Davis 5-3922

L. E. "Riley" Moos
5822 Harvey Wilson Drive
Houston, Texas
Telephone WE. 7344

Thorson Oil Tools Ltd.
7106 103rd Street
Edmonton, Alberta, Canada
Telephone 393-838

LOOK BEHIND THE SLIPS

Specialized Construction provides each slip with 100% hanger body support throughout the entire length of slip travel—no cracked or broken slips—positive operation—all the area of each slip securely grips the casing.

1. 2. 3.

1. BURNS LEAD SEAL CASING HANGER *with hold down slips. Slips set automatically after casing is suspended.*
2. BURNS CIRCULATING TYPE CASING HANGER *with lead seal pack off. On cementing jobs this hanger assures easier circulation around the hanger and positive seal after cementing.*
3. BURNS DELAYED ACTION LEAD SEAL PACK OFF CASING HANGER. *Same features as the Burns circulating type except the by-pass ports are eliminated. You can hang your oil string, circulate, and cement before closing the lead seal packing element.*

UNIVERSITY LANDS

OIL AND GAS LEASES

To Be Offered By

THE BOARD FOR LEASE OF THE UNIVERSITY OF TEXAS LANDS

at

THIRTY-FIFTH PUBLIC AUCTION

Tuesday, June 28, 1955

Commencing at 10:00 A. M. at the
Commodore Perry Hotel, Austin, Texas

List of leases and additional information obtainable from

UNIVERSITY LANDS—GEOLOGY
P. O. Box 1663
Midland, Texas

BOARD FOR LEASE OF UNIVERSITY LANDS
P. O. Box 7986—University Station
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When we say quick delivery, we mean *quick delivery!*

"Here comes your Worthington QD Sheave — the original two-piece design."

We're talking about the speedy service you get when you order a Worthington QD sheave or V-belt from your local Worthington distributor (or supply store). He's got a dollar-saving way of getting you exactly what you want — *when you want it.*

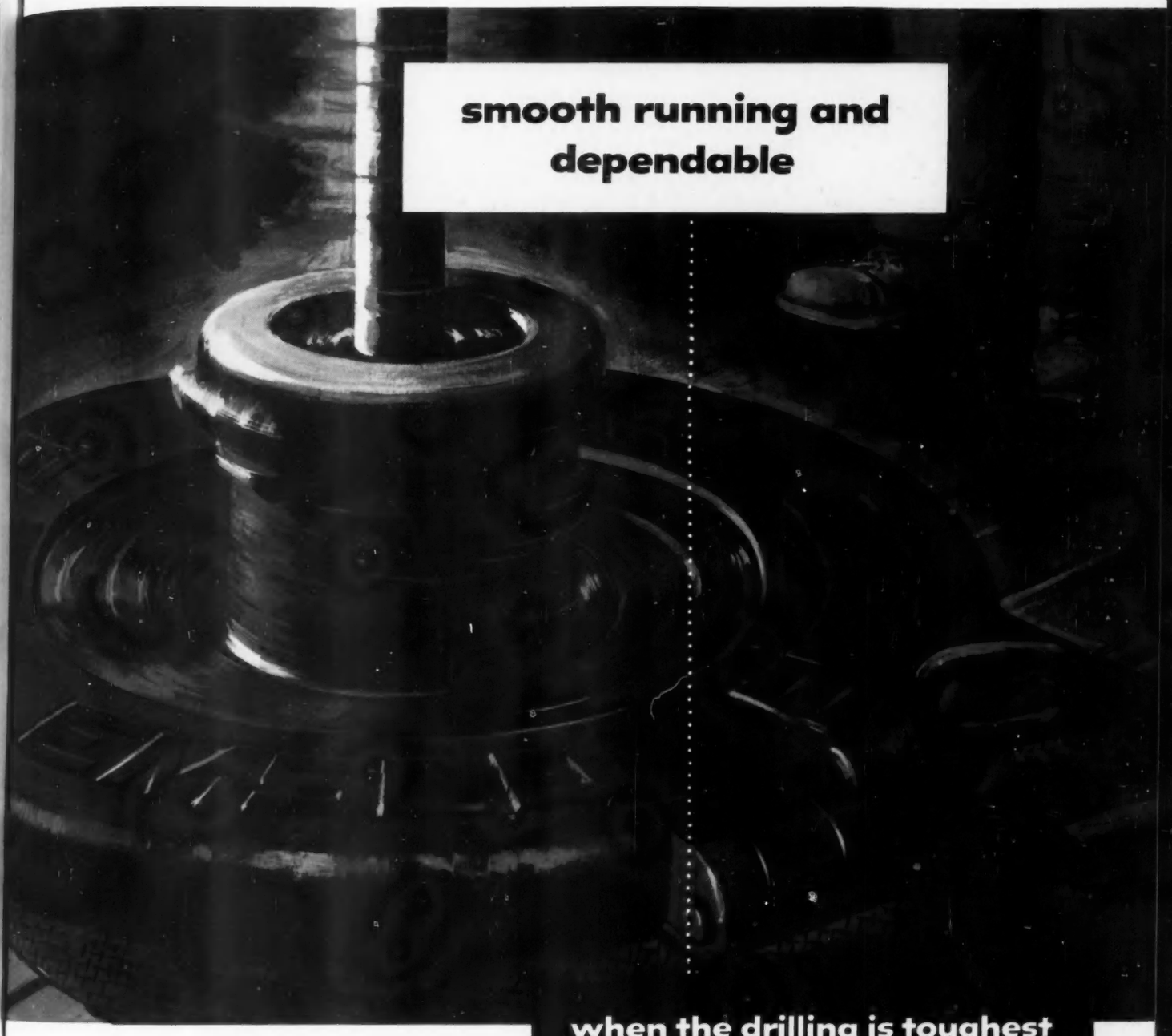
QD, by the way, stands for Quick Detachable, which the Worthington sheave certainly is. The original two-piece sheave, it's also easy to get on and stays *tight* on the shaft.

Ask about Worthington QD sheaves and belts next time you stop by your supply store. MV.5.8

WORTHINGTON

Buy These Worthington Standard Products From Your Local Distributor

COMPRESSORS • MULTI-V-DRIVES
VARIABLE SPEED DRIVES • PUMPS



smooth running and dependable

when the drilling is toughest

Superior design and construction of Emsco P Rotary Machines assure quieter, smoother, longer-lasting performance.

Bearings and gears are completely protected from tonging shock. A table-locking lever engages notches in the table top flinger and locks the body only, thus the shock load is not transmitted through bearings and gears.

Emsco P Rotaries are effectively sealed from entry of mud or other foreign material. A mud flinger underneath the circular guard throws the mud away from the table center, thus preventing it from getting within the walls of the box.

All P Rotaries are equipped with flame hardened, precision-machined spiral bevel gears. Strong, rectangular fabriform cases make flooring-up simple and easy.

An efficient flood lubrication system is provided from a large central, sealed oil reservoir. Pinion bearings are independently grease lubricated.

Call CONTINENTAL for detailed information on these outstanding Emsco P Rotary Machines. Available in three sizes: 17½", 20½" and 27½".

CONTINENTAL

Serving the Oil and Gas Industries

THE CONTINENTAL SUPPLY COMPANY

General Offices: Dallas, Texas

Representatives in all principal oil fields of the world

EMSCO

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EMSCO MANUFACTURING COMPANY

Garland, Texas LOS ANGELES, CALIF. Houston, Texas

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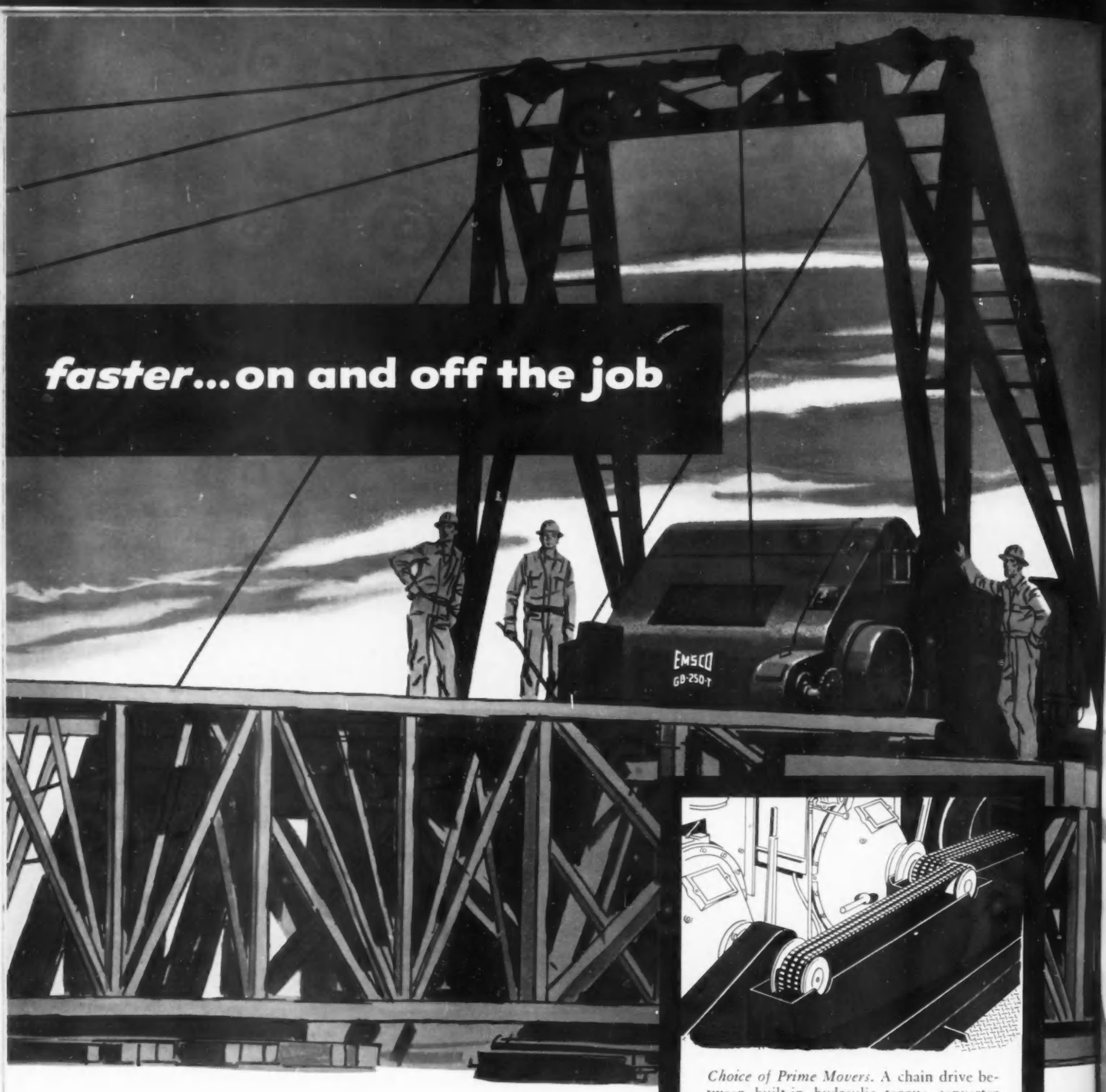

Choice of Prime Movers. A chain drive between built-in hydraulic torque converter and engine (or engines) gives the operator complete freedom of power selection.

EMSCO's Little Rigs, GB-160-T and GB-250-T, are rugged, lightweight and completely portable . . . get you on and off the job faster.

Rig-up time is substantially reduced. EMSCO Little Rigs are packaged as a unit and can be moved without breaking oil or air lines.

Designed for shallow to medium depth wells, servicing and deep workover, these smooth running torque converter rigs have big rig features. An inboard-mounted torque converter, driving through a two-speed selective transmission, provides an infinite range of speeds and permits use of maximum obtainable horsepower at any time.

Controls are in a forward-mounted console, with one-lever control valves for hoisting and rotating. Friction clutches are direct air-operated. Neutral brakes provide greater safety and ease of operation. Call CONTINENTAL for details on EMSCO's dependable GB-160-T and GB-250-T.

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Well Done with SECURITY

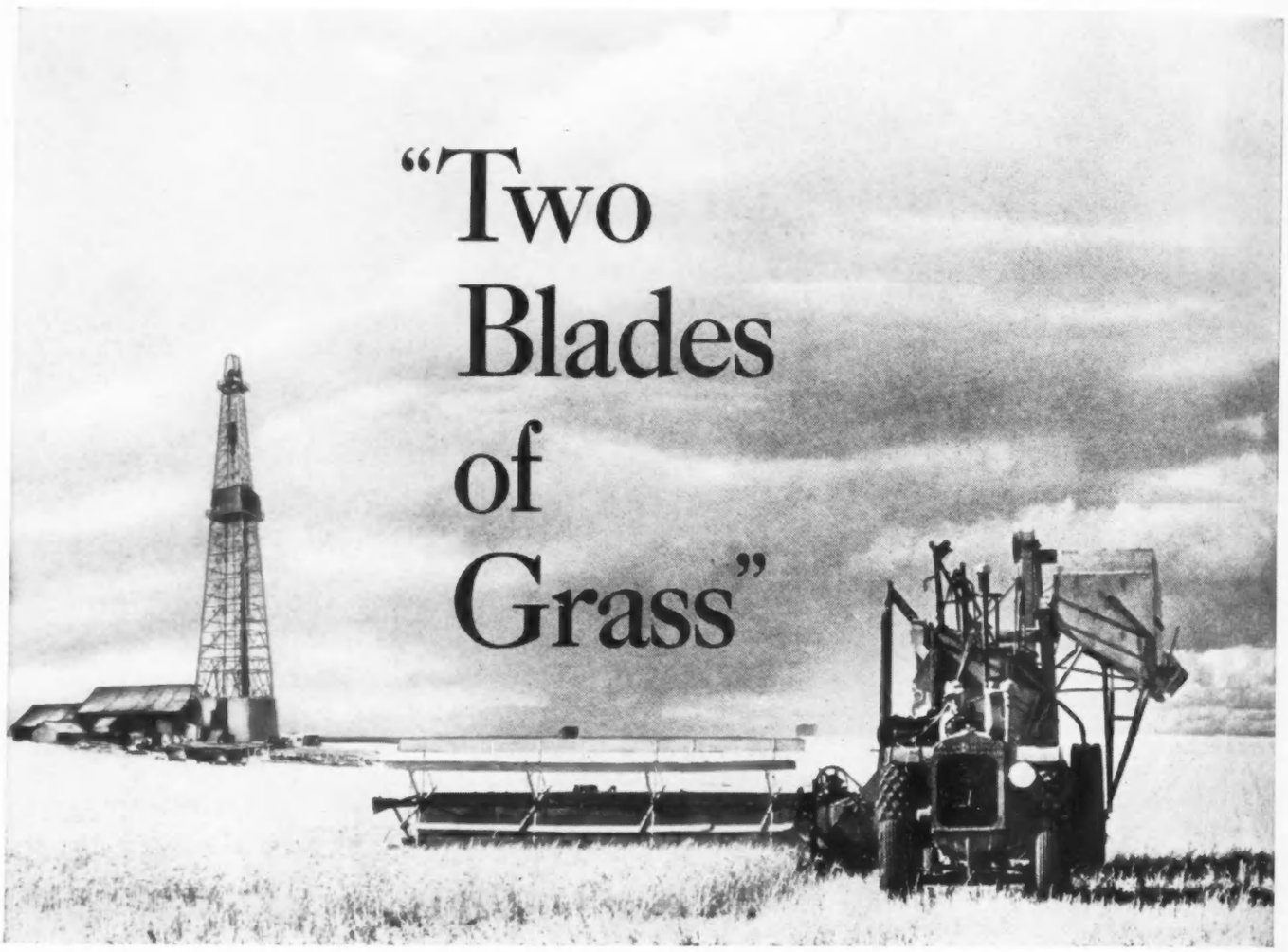
There's a good reason why more and more rigs are running Security rock bits ...simply *proven performance*. Performance consistently repeated over and over again because Security's rigid quality control insures first line bits at all times. Security bits with their new cutting patterns, advanced bearing design and metallurgy can do the same outstanding job for you. For fast, outstanding "Well Done" performance, *Get Securtiy in Your Drilling.*

Security

ENGINEERING DIVISION

One of the Dresser Industries

DALLAS, TEXAS • WHITTIER, CALIF.



TWO CENTURIES ago Voltaire said, "He who makes two blades of grass grow in place of one renders a service to the nation." The job of Standard Oil Company (New Jersey) and its affiliates is something like that – to produce oil where none was produced before and, by so doing, to create wealth for everybody.

How well have we been doing this job? Our Annual Report for 1954, which has just been sent to the 300,000 shareholders who own Jersey Standard, tells about it.

It tells how wealth was created by extending known oil fields . . . And by discovery of new ones . . . By converting crude oil, itself of little value, into hundreds of useful products . . . By moving petroleum products from where they were made to where they were needed.

All these things helped the people and strengthened the nations where we do business.

Some highlights of these activities, drawn from the Annual Report, are set forth here as a matter of public information.

1. During 1954, the free world used more oil than ever before. And oil is energy, which is basic to the world's progress.

2. To meet these needs, our affiliates produced and refined more oil than ever before in the Company's history. But additions to oil reserves were greater than the oil used.

3. We had vigorous competition everywhere. There is nothing like competition to bring you better products and service.

4. 1954 was our top year in sales, earnings, and dividends paid to owners.

5. During the year, we spent 764 million dollars for new equipment and for exploration. Since World War II, we have spent 5 billion dollars for the means to meet your future oil needs.

6. Research was productive. Our research affiliate obtained more patents on products and processes than any other oil company. In Linden, N. J., the first atomic laboratory in the oil industry is being built to study the uses of radiation in oil refining.

7. Current developments in atomic energy will mean greater availability of electric power: increased mechanization, expanded industry, and greater use of petroleum products. The oil business will gain, and you will have the benefits of both kinds of energy.

8. We played an important part in arranging to return Iran's oil to world markets.

9. A world's safety record for major refineries was set by Esso employees at Baton Rouge, La....7,911,769 man-hours with no disabling injury. This passed the previous record by more than a million man-hours.

10. We have long supported education through our taxes. We have also felt an obligation to aid privately supported colleges and universities, which are an important source of new employees and of informed citizens. During 1954, we contributed about a million dollars to such institutions.

**If you wish a copy of the full Report for 1954, write to Standard Oil Company (New Jersey), Room 1626, 30 Rockefeller Plaza, New York 20, N.Y.*

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

Esso

The UNDERWRITER . . . . .

. . . a specialist in WORKMEN'S COMPENSATION INSURANCE

The TEIA Underwriter is a specialist in Workmen's Compensation Insurance, with a thorough understanding of the employer's problems and the special provisions of the Texas Workmen's Compensation Law.

Let the TEIA Underwriter and the SERVICE TEAM, of which he is a part, work with you . . . to improve your Workmen's Compensation Insurance coverage and service . . . and SAVE you money.

Millions of Dollars saved policyholders by Texas largest writer of Workmen's Compensation.

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*

Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO FORT WORTH • FREEPORT • GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND ODESSA • PORT ARTHUR • SAN ANGELO • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE - DALLAS, TEXAS

WORLD OIL'S Trading Post
CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) **set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. Situation wanted ads, 6 cents per word. Display ads, set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

HELP WANTED

Managerial Personnel Needed

FOR RESEARCH CENTRE IN THE PETROLEUM INDUSTRY

Ente Nazionale Idrocarburi (E.N.I.) has under its supervision a number of Italian Companies active in the field of petroleum and petrochemicals. ENI's major activity is centered in the following items:

—**gas and oil field exploration and exploitation (current production: 105 billion cu. ft. of natural gas per year);**

—**operator of a 2500-mi. pipe-line system (capacity over 700 million cu. ft. per day);**

—**owner and operator of a tanker fleet of around 120,000 dwt;**

—**owner and operator of an extensive network for distribution of petroleum products and LP-gas throughout Italy (64 Bulk plants, 4000 stations, etc.);**

—**control over or shareholding in refineries having a processing capacity of about 6 million tons of crude oil per year;**

—**owner of factories (1500 employees) for construction of machinery;**

—**shareholding of chemical plants (700 employees) for production of synthetic dyes, detergents, etc.;**

—**under construction, a petrochemical plant (production capacity—30,000 tons per year of synthetic rubber and 350,000 tons per year of ammonium nitrate).**

E.N.I. is organizing a big research centre for investigation and development of petroleum processing and manufacture of petrochemicals. Some departments are expected to begin operation next summer.

Italian or foreign technical experts, with a wide educational background, specific training, organizational and managerial ability, are required to fill positions as heads of the main departments of the laboratories.

Specifically the following are sought:

1) **Chemist or physicist with specific knowledge and experience in thermodynamic and chemico-physical problems;**
2) **Chemist specialized in the preparation of organic compounds, particularly those derived from hydrocarbons;**
3) **Inorganic chemist soundly and completely acquainted with modern methods of experimentation, research and testing;**
4) **Engineer or industrial chemist specially trained in the methods for improving petroleum products applications;**
5) **Engineer or physicist, with physico-technical and technological training, specialized in the problems of thermo-technics, measurements and controls;**
6) **Engineer or industrial chemist with extensive research experience in the field of crude oils processing;**
7) **Engineer or industrial chemist particularly experienced in extending laboratory procedures to pilot plants;**
8) **Engineer with good theoretical knowledge and laboratory experience in engine tests on fuels and lubricating oils;**
9) **Engineer or industrial chemist specially trained both in theory and practice in the fields of corrosion and protective means for materials.**

Note: University degree mandatory.

Applications should state age and other usual personal data, educational background and qualifications, practical experience, etc., and should include a photograph. Please address personally to the **Presidente dell'Ente Nazionale Idrocarburi, Via Lombardia, 43—Roma—Italy,** with the special note **RISERVATA PERSONALE** (i.e., to be opened by addressee only).

Absolute discretion in every respect is assured.

Salary offered will be in accordance with position, training and qualities required.

HELP WANTED

Petroleum Engineer
Petroleum Geologists

Applications are invited from graduates of a recognized University for responsible positions in Saudi Arabia.

Applicants must have had a minimum of five years practical experience.

Salary to be offered will be commensurate with the qualifications and experience of candidates accepted. Liberal travel and living allowances provided.

Two months' vacation upon completion of eighteen month contract.

Applications stating age, marital status, qualifications, experience, and availability should be addressed to:

General Director
Petroleum & Mineral Affairs
Ministry of Finance
Jeddah, Saudi Arabia

BUSINESS OPPORTUNITIES

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY
P. O. Box 1628, Hobbs, New Mexico, Phone 3-3141
146 Allen Building, Midland, Texas, Phone 2-2962

FOR SALE

■ WELL DRILLING MACHINE—2 No. 72 Speed Stars, 1 #72 and 1 #83 Stars for sale with or without tools, lines, equip. Compl. rotary attach. & 1500′ drill pipe for #72 and #83. Also Cardwell 5000′ rotary outfit compl. 5000′ 4″ drill pipe. Jackson-Markus Supply Co., 3612 E. 26 St., Los Angeles.

GASOLINE PLANT FOR SALE

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

■ Complete Widco, two curve, electrical logging unit. Six thousand foot depth, hydraulic drive, mounted in one-ton G.M.C. panel. Like new, fully equipped with all accessories, ready for immediate field operation. Box 59-W, c/o WORLD OIL, Houston, Texas.

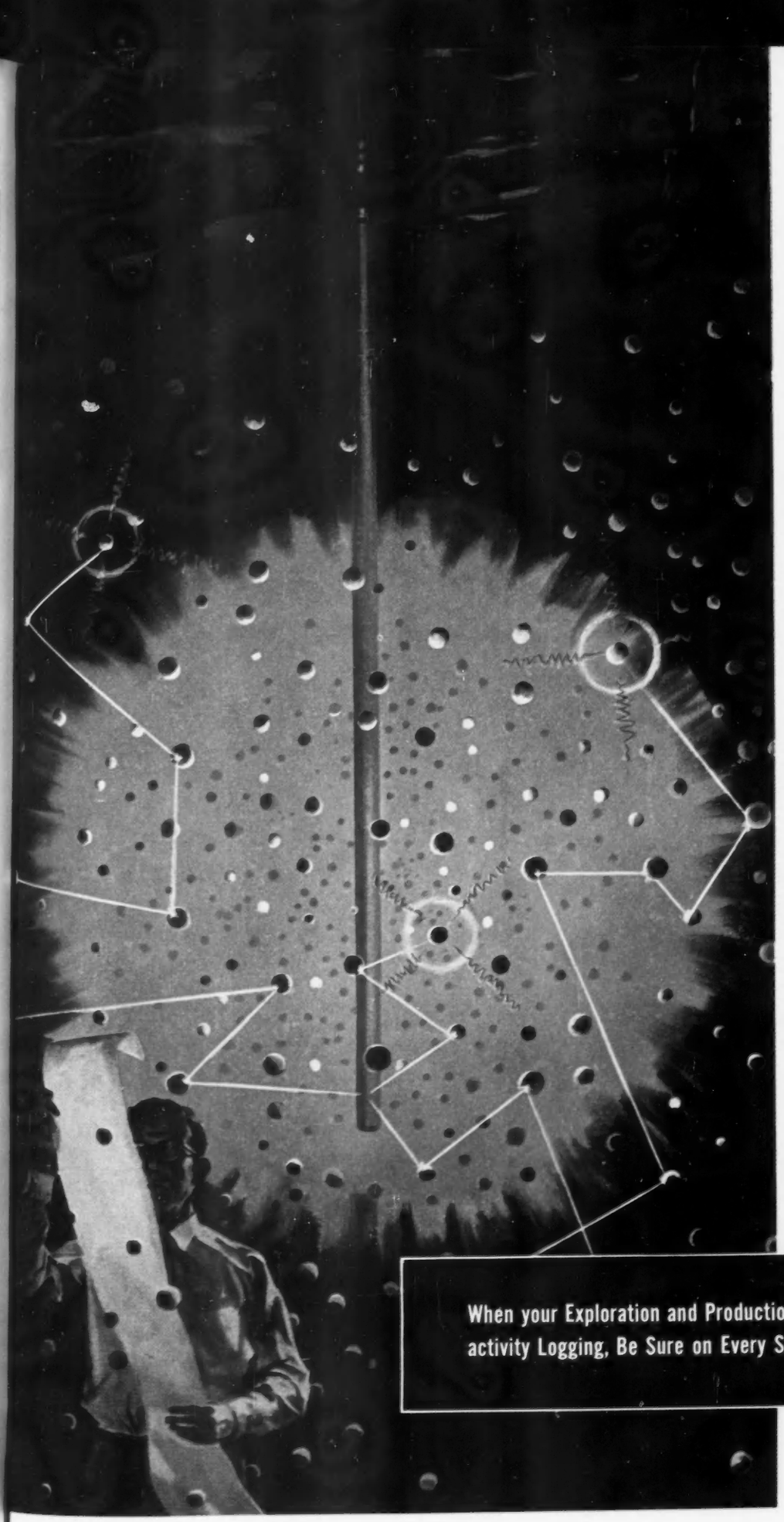
GOOD #1 GRADE USED 8″ LINE PIPE FOR LESS!

Save almost ½ the cost of new pipe.

Lapweld 8⅝″ O.D. 28.55 used pipe. Straight single random lengths. Machine cleaned. Plain and bevelled or screw end. 850 to 900 PSI. Pipe located in Illinois. Will sell for cash, or will finance meritorious propositions.

REDNEB PIPE CO.
P. O. Box 1798, Shreveport, La.
Phone 2-3276

■ WE BUY, WE SELL spudders, rotaries, core drills, tools in all areas. If you want to buy or sell, contact, PRESSEY & SON, Pueblo, Colo.



NOW, YOU CAN HAVE SCHLUMBERGER QUALITY IN RADIOACTIVITY LOGGING

Schlumberger Gamma Ray and Neutron Logs offer these unique advantages:

They are recorded simultaneously on film and prints are immediately available in the field. The finished log is delivered to you without tracing.

They are unaffected by high drill hole temperatures. No base line correction or adjustment is necessary.

They are dependably and accurately calibrated in easily used units.

The instruments are built in sizes appropriate for all open and cased hole conditions. Separate instruments—both Gamma Ray and Neutron—are available for operation in 2″ tubing.

Increasing numbers of the Schlumberger Gamma Ray instruments employ a very sensitive scintillation detector.

The designs of the Neutron instrument and the protective source carrier, positively eliminate radiation hazards.

When your Exploration and Production Programs include Radioactivity Logging, Be Sure on Every Survey—call Schlumberger.

For additional information, call your local Schlumberger engineer, or write for our brochure on Radioactivity Logging.

SCHLUMBERGER

Well Surveying Corporation

THE EYES OF THE OIL INDUSTRY

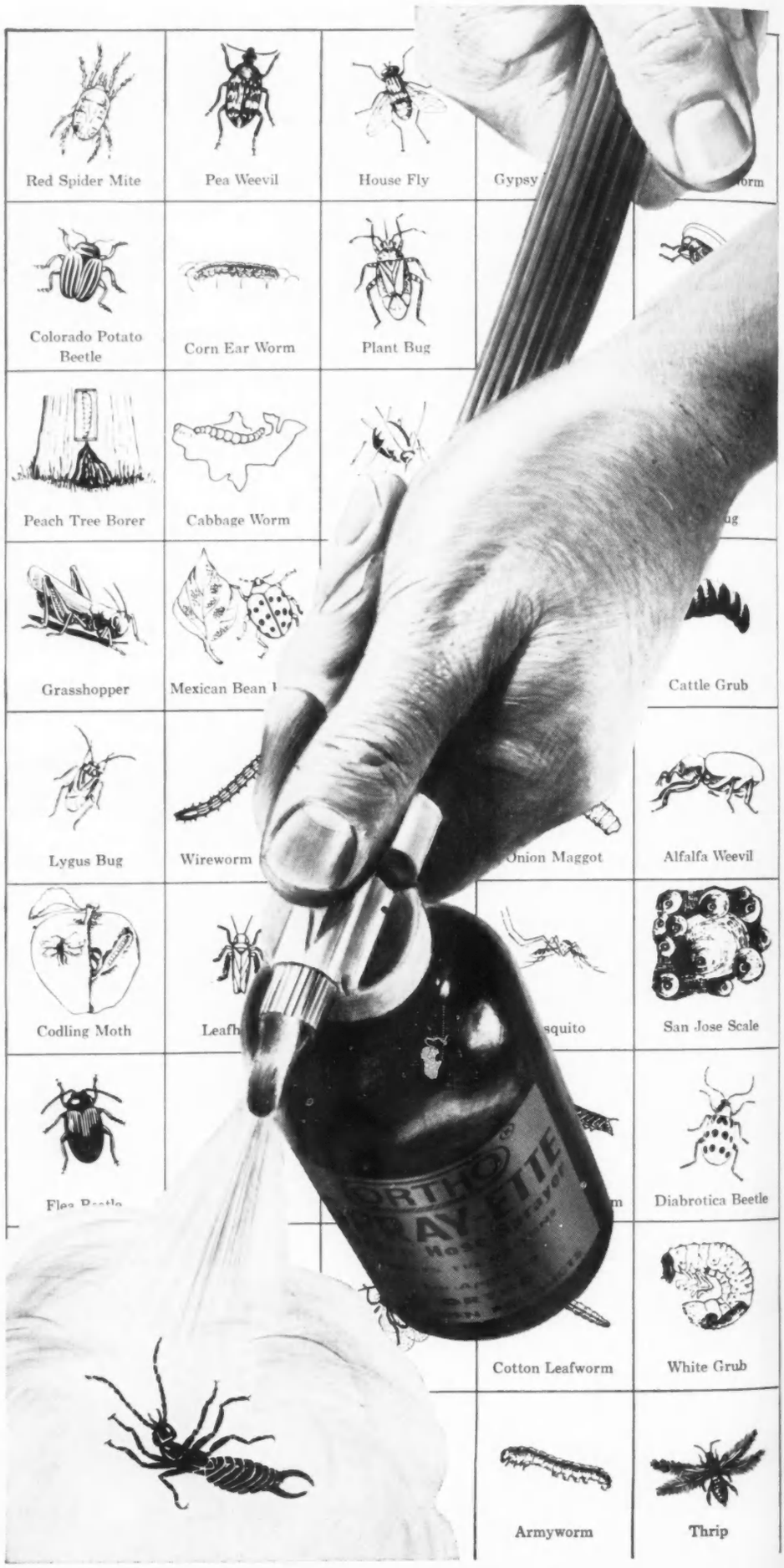
There's not enough food for you and the bugs

As any backyard gardener knows, you have a fight on your hands from the moment you turn over your first spadeful of earth. At every step, fungus growths, weeds, and insects that chew, insects that suck are waiting to destroy your lawns, trees, plants, flowers. It is a disheartening struggle for Greenthumbers . . . a round-the-clock fight for commercial farmers.

Fortunately, there's a growing list of weapons we now can wield in the battle against bugs. Some of the most effective have been developed in the laboratories of California Spray-Chemical Corporation, a Standard Oil Company of California subsidiary. In 1907, we brought out the first basic lead arsenate to stop the codling moth, a rampaging fruit crop destroyer; later, the invention of new-type summer and dormant oil sprays safely checked scale and other insects.

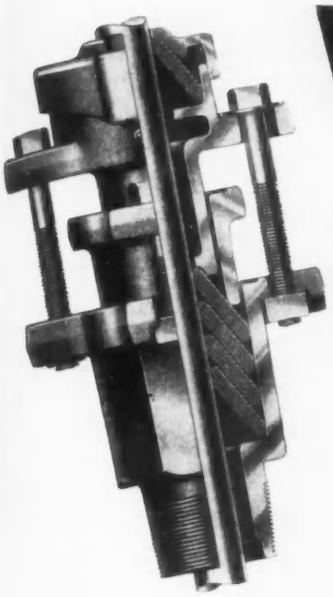
Other Standard research achievements have been chemicals to kill aphis, mites, thrips, and similar sucking insects . . . dusts to destroy fungus diseases like rust, blight, mildew...sprays and dusts custom-made to knock out such public enemies as the devastating grasshopper, boll weevil, hornworm. Other pest-killers boost milk production from our dairy herds, help beef cattle fatten faster.

One good reason you live in the world's best-fed nation is because insect invaders have been held back on our farms, ranches, and orchards, thanks in part to Standard's constant hunt for new ways to make petroleum do more things for you.



STANDARD OIL COMPANY OF CALIFORNIA ***plans ahead to serve you better***

For a BETTER production job use HERCULES STUFFING BOXES



1
"REGULAR TYPE"
DUPLEX POLISHED ROD
STUFFING BOX

2
"TEE BASE
TYPE"
DUPLEX POLISHED
ROD STUFFING BOX-TEE

All Hercules Stuffing Boxes are made of high grade malleable iron which prevents shattering if rods drop. They are tested to 3,000 pounds psi pressure and all use the famous Hercules split cone packing rings.

3
"TYPE DP"
DUPLEX POLISHED
ROD DOUBLE PACKED
STUFFING BOX

1
The old reliable, tried and proved in thousands of wells from coast to coast and for many years.

2
A combination Stuffing Box and Pumping Tee. Makes a short connection and bolt lugs on body placed low to prevent fouling elevator links, No Bell Nipple needed as top of body will support elevator. Full opening — unnecessary to remove body when pulling or running rods.

3
Designed for use on wells that flow intermittently and is especially desirable for wells located near buildings, fire hazards or growing crops. Two compression bolts, in bottom sections are tightened on Cone Rings to pack-off while replacing packing in upper section.

SOLD AT ALL SUPPLY STORES

DESIGNED AND RECOMMENDED *By the men who use them*

Write for Complete Information

HERCULES TOOL COMPANY

SINCE 1924

Manufacturers of Oil Field Equipment

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. • 30 Church Street, New York, N. Y.

40 YEARS EXPERIENCE

40,000 MILES . . .

. . . PIPELINES are NOT sidelines with . . .

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ENGINEERS and CONSTRUCTORS

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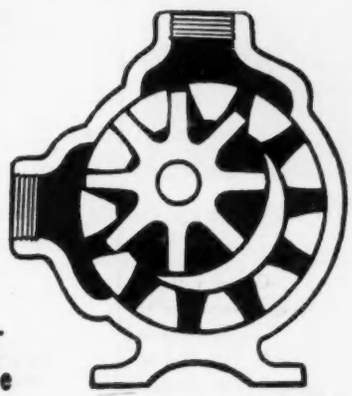
VIKING ROTARY PUMPS



• Cut-Away View Showing Viking's Gear-Within-A-Gear Principle

The unique and unusually simple construction of Viking Pumps . . . with only two moving parts . . . assures you of long, easy-maintenance operation with all grit-free liquids.

Let Southern Engine & Pump Company show you how Viking Pumps can solve your pumping problems. We invite your inquiries.

Distributors

SOUTHERN ENGINE & PUMP COMPANY

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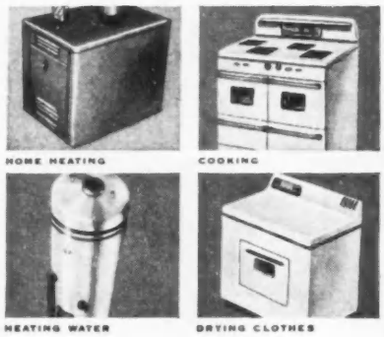
buried a million years
...now serving the nation

A new titan is at your beck and call!

Natural gas, the giant imprisoned in the earth until the pipeline unleashed its mighty power.

Now a billion and a half cubic feet of the world's finest fuel flow daily through the 2200-mile pipeline of Tennessee Gas. The nation's longest, this great artery brings natural gas from the Southwest where most of it is to the fuel-hungry East where it's needed most.

And does it by the simplest, most direct means of transportation known . . . delivers it dependably, economically to homes and industry round the calendar and clock . . . by pipeline.

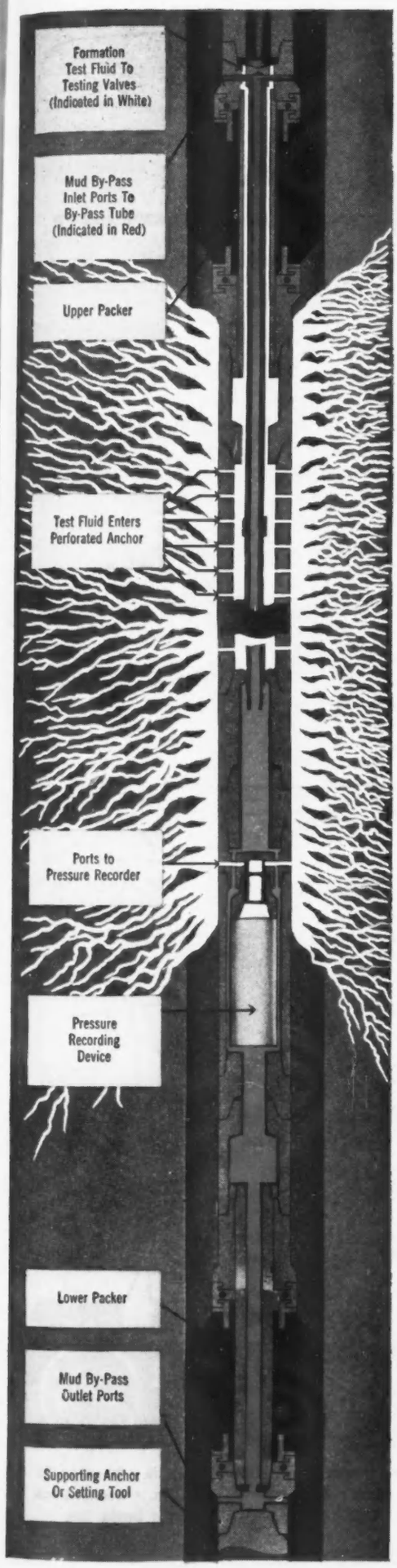


TENNESSEE GAS
TRANSMISSION COMPANY
HOUSTON, TEXAS
AMERICA'S LEADING TRANSPORTER OF NATURAL GAS

One of a series of advertisements appearing in full color in national publications.

KEEPING AMERICA INFORMED! Natural gas . . . an industry that grows in size, importance and service to the nation every year. The TENNESSEE GAS TRANSMISSION COMPANY is proud to publish these advertisements . . . which tell the facts to the American people . . . for the benefit of the entire industry.

TENNESSEE GAS TRANSMISSION COMPANY
HOUSTON, TEXAS


Formation Test Fluid To Testing Valves (Indicated in White)
Mud By-Pass Inlet Ports To By-Pass Tube (Indicated in Red)
Upper Packer
Test Fluid Enters Perforated Anchor
Ports to Pressure Recorder
Pressure Recording Device
Lower Packer
Mud By-Pass Outlet Ports
Supporting Anchor Or Setting Tool

Straddle Testing

in open hole

another Johnston first*

Now, with complete confidence, you can...

- **EVALUATE UP-THE-HOLE ZONES**
- **LOCATE GAS, OIL, AND WATER CONTACT**
- **HELP PROTECT HOLE AND SUPPORTING ANCHOR**

See how Johnston Straddle Testing with STRADDLE MUD BY-PASS maintains full hydrostatic mud pressure on upper and lower packers—and on all formations below lower packer. Lessens the load on supporting anchor and prevents production from any lower zone in the event of lower packer failure. Should either packer fail, you get an immediate surface indication. Get all these advantages plus ease of running tool into and out of the hole.

*Johnston Straddle Testing with Straddle Mud By-Pass is covered by patent and patents pending. Another Johnston first!

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JOHNSTON TESTERS

first in drill stem testing

P. O. Box 98,
HOUSTON, TEXAS

LOS ANGELES, CALIF • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON

ST 558

Immediate Delivery!

NEW MODEL Series 53 CURTIN CENTRIFUGES

with 7 improvements

Aluminum castings reduce weight one-third to approximately 5-1/4 lbs. . . . Diameter of drive shaft increased from 7/16" to 1/2" for added strength . . . Gear train redesigned for more efficient operation . . . Both 15 cc and 100 cc sizes use the same crank . . . Spindle shaft ball bearing mounted, easier to turn . . . Drive shaft of corrosion resistant stainless steel . . . Spindle of corrosion resistant stainless steel.

Write for bulletin 53

W. H. CURTIN & CO.

DOMESTIC EXPORT • Established 1922

CURTIN

LABORATORY APPARATUS, FURNITURE & CHEMICALS

HOUSTON • NEW ORLEANS
BIRMINGHAM • CORPUS CHRISTI • TULSA

A long record of close association with the oil and gas industry

FIRST NATIONAL BANK

BUILT ON SERVICE 1st SINCE 1866

in Houston

MEMBER: F. D. I. C.

Now! for greater safety

New Safety GRIP-STRUT stair treads custom made to your exact size . . . Here for the first time is a really SAFE stair or ladder step, combining the proven features of Safety GRIP-STRUT material with a double locked carrier plate to provide additional safety over present types.

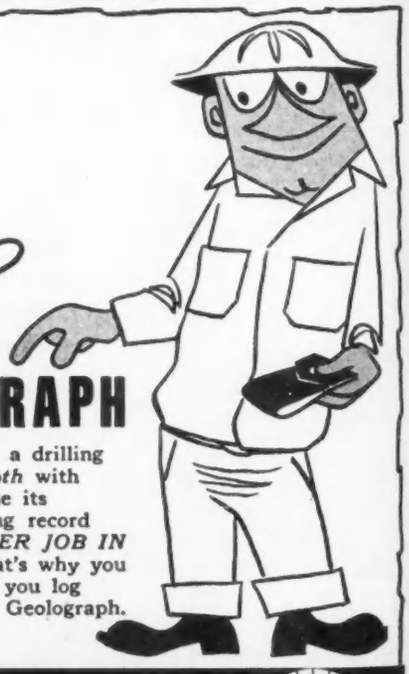
Made to your own individual size at the factory, the cost is amazingly low . . . you can buy a standard 18" stair tread in lots of 50 for $2.40 each. Prices proportionately lower in greater quantities.

Distributors in all principal cities. Consult your classified telephone directory.

GRIP-STRUT division
The Globe Company
Manufacturers since 1914
4008 S. Princeton Ave. • Chicago 9, Illinois

Going in the HOLE?

USE GEOLOGRAPH



Time is money on a drilling well! You save *both* with Geolograph because its foot-by-foot drilling record helps do *A BETTER JOB IN LESS TIME!* That's why you always save when you log as you drill with Geolograph.

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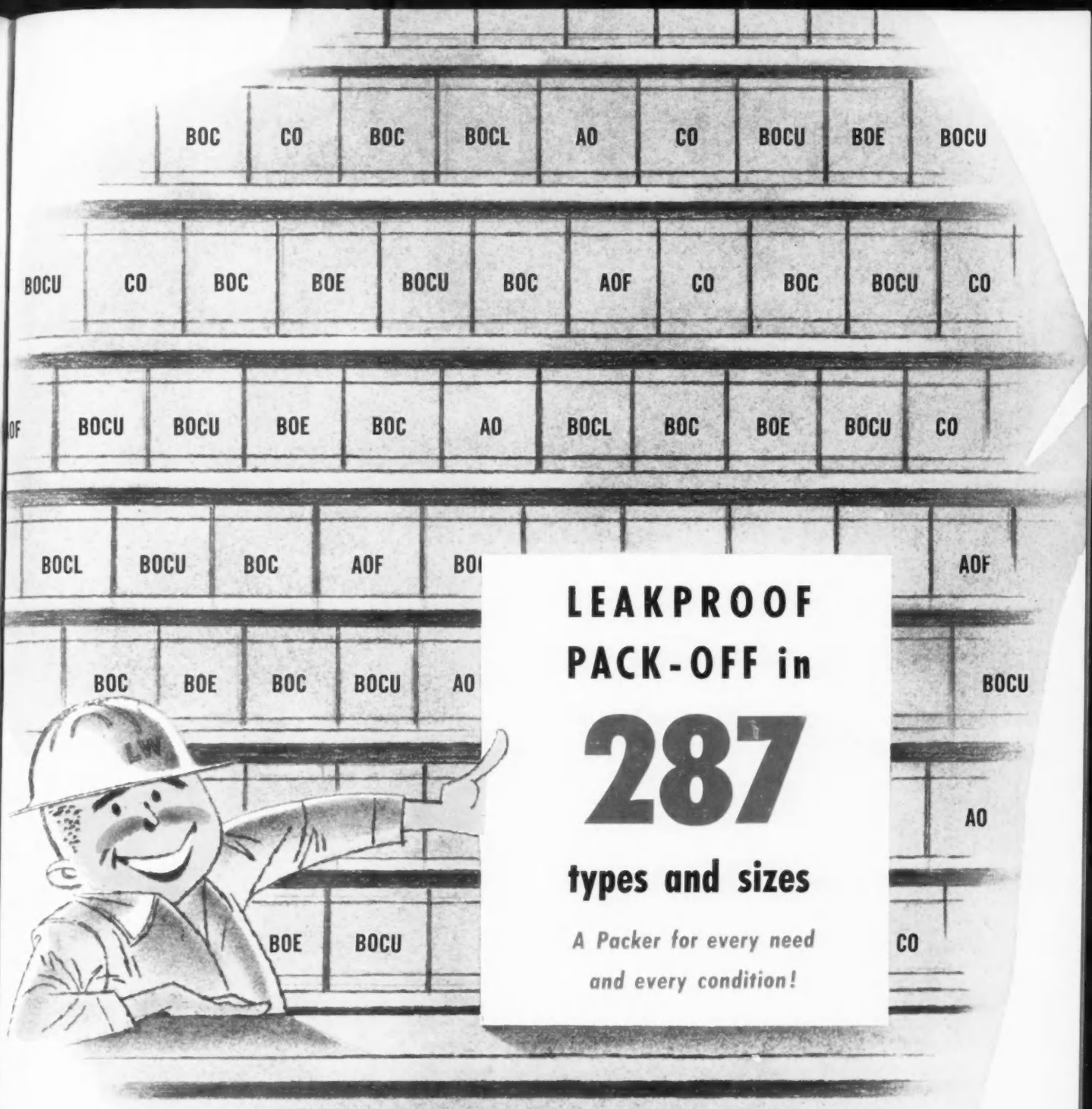
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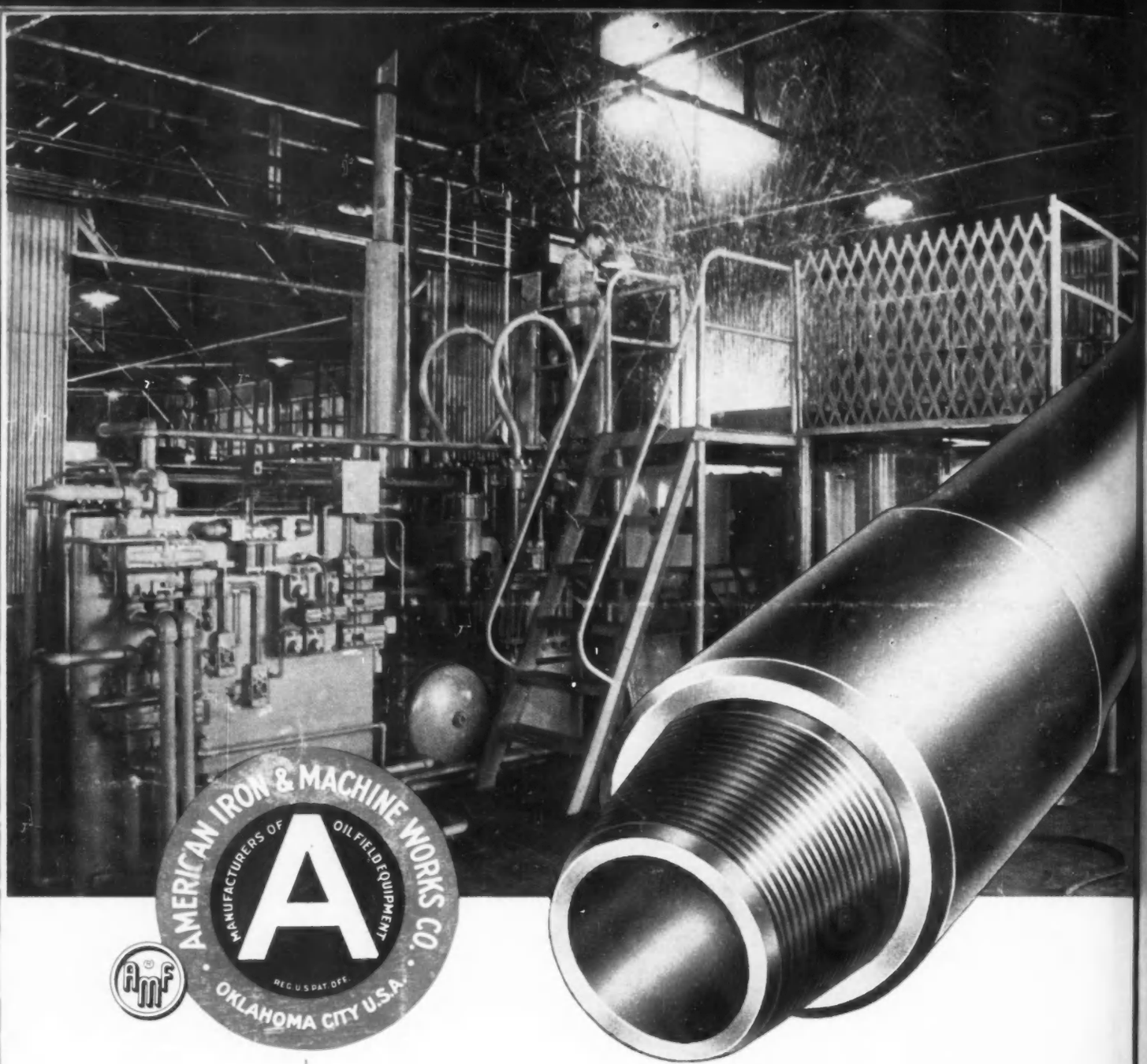

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